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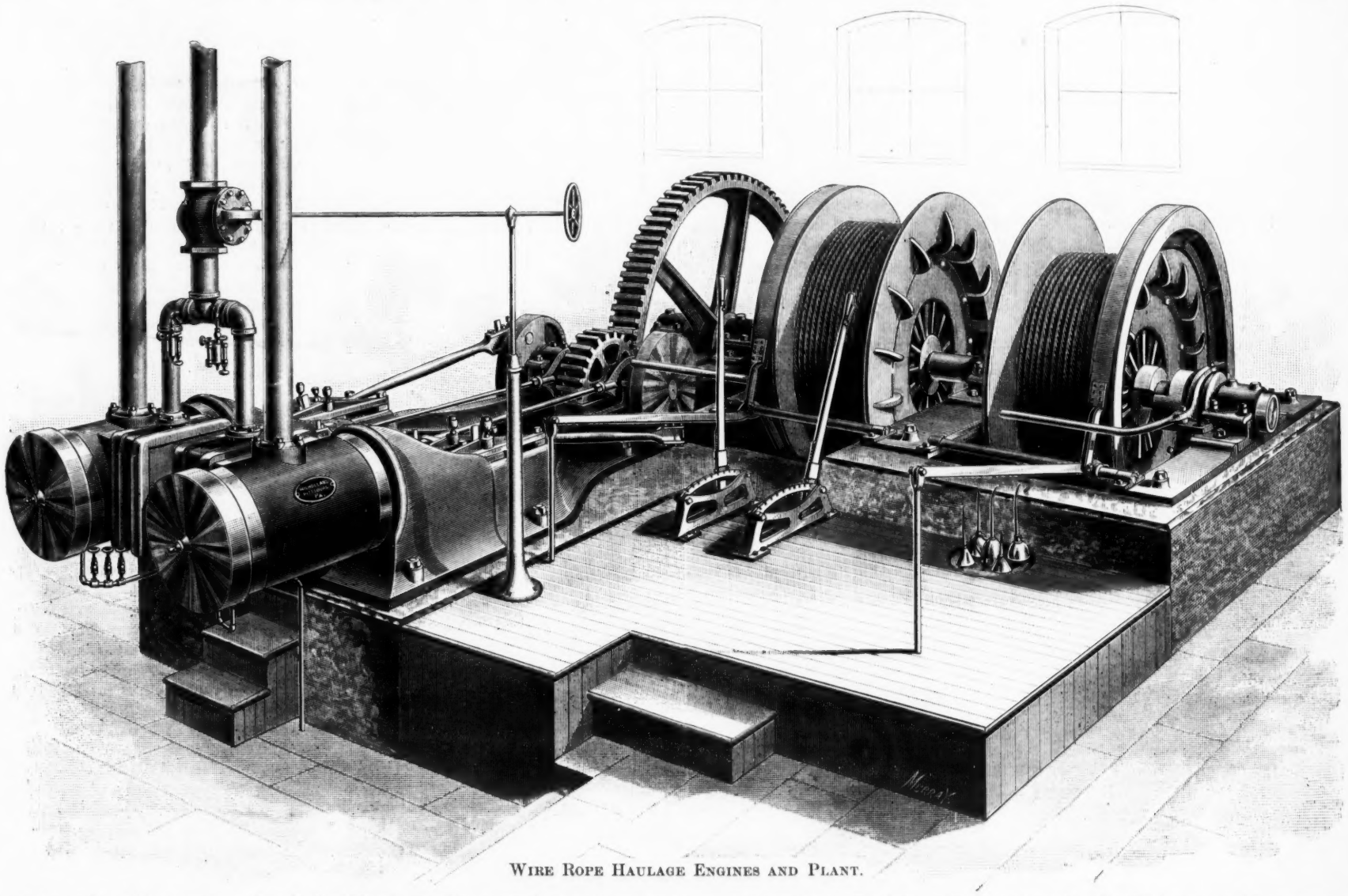
Wire Rope Haulage Engines and Plant.

With this we give an illustration of a complete plant of a pair of wire rope haulage engines and apparatus designed to haul mine cars through a distance of 2¼ miles on a grade 4 feet in 100, the load consisting of 40 to 60 mine cars, each weighing 6,200 pounds. The engines have cylinders 14 inches diameter; stroke of piston, 24 inches. The



WIRE ROPE HAULAGE ENGINES AND PLANT.

connecting rods, piston rods, and valve stems are made of hammered steel; and phosphor bronze bearings are used in all the boxes.

The drums are 5 feet in diameter, width of faces 36 inches, with flanges on drums 12 inches deep; they are turned all over. A brake is attached to each drum for controlling the motion of the mine cars during the descent on grades. These brakes are operated by the quadrant levers on the platform shown in front of the drums. The throttle valve is operated by the small wheel placed at some distance from the valve, so as to bring it and the quadrant levers within convenient reach of the engineer.

The power is transmitted from the engine to the drums through the spur gearing, having a proportion of 3½ to 1. The ropes, which will be eventually 2½ miles long, are arranged so that a rope is wound on one drum while the other is unwound.

This plant has been recently erected for the American Coal Co., of New York City, and has been in operation for several months, working very satisfactorily. During a trial, 45 mine cars were hauled up the 4 per cent. grade through a distance of 5,000 feet in 8 minutes with comparative ease.

This plant is equipped with all the modern appliances, including sight-feed lubricators, drain pipe connections, and all such as will be conducive to convenience and durability, and no pains have been spared in making it durable, convenient, and modern in design. Although the builders of this plant, Messrs. J. & J. B. Milholland, of 240 Fifth avenue, Pittsburgh, Pa., have now over one hundred haulage plants in successful operation, they take particular pride in this one, and believe it to be one of the best haulage plants that has been erected.

The failure of attempting to establish a law that shall regulate matters as between employers and employes is very well exemplified in the action of the courts to compel the enforcement of the weekly pay-day law in New York. So many ways are found for evading this law that the idea of letting men settle their own affairs is strongly suggested.

A press dispatch from Pittsburgh says: The Edgar Thomson Steel Works now hold the record for making steel rails. In twenty-four hours, ending at 6 o'clock this morning, 1,907 tons of rails were turned out. This beats the best previous output in the same time at the South Chicago rolling mill by 232 tons. The works were operating on seventy-pound rail, and made a total of 6,195 in the day. Manager Schwab started out to do 1,800 tons.

If the price of iron is kept, in this country, about as low as in England, there is no reason why shipbuilding shall not receive a vigorous boom here. The labor will cost no more here than in England; and the cost of the material should be no greater, for any apparent reasons.

If we have to contend, in shipbuilding, against abnormally high prices of material, then there is not much chance of building many ships in this country.

Something more than a year ago the employes of Flather & Co., Nashua, N. H., were invited to a jollification upon the completion of an extensive addition to the works. Recently the employes convened and decided to perpetuate the matter, so another gathering was held this year at the Laton House. A large number of the employes were present, as well as a goodly number of invited guests. The occasion was an enjoyable one.

The *St. James Gazette*, in referring to the new navy of the United States, pays this country a good many compliments. It doubts the ability of the crack English cruisers to compete, in battle or in speed, with the "New York."

Mill Construction.

Mr. C. J. H. Woodbury lectured at the Brooklyn Institute, January 12th, on the Development of Mill Construction, illustrating the subject by a large number of photographs of mills thrown on the screen, representing mills of various types of construction, beginning with those of many years ago and advancing step by step to those of the present day.

The various methods of building are naturally subjects of special interest to the architect and the civil engineer, but these changes have all resulted from improvements in machinery, being fundamently the result of improvements in water wheels, which were followed by new methods in the transmission of power, and then finally the greater economies in the steam engine, which allowed the construction of mills away from the water-courses and at other points where the freight facilities were good, and where areas of nearly level land could be obtained in proximity to cities and towns containing a population which could be employed in the mill.

One of the important results in a commercial sense which has attended the introduction of slow-burning mill construction, of

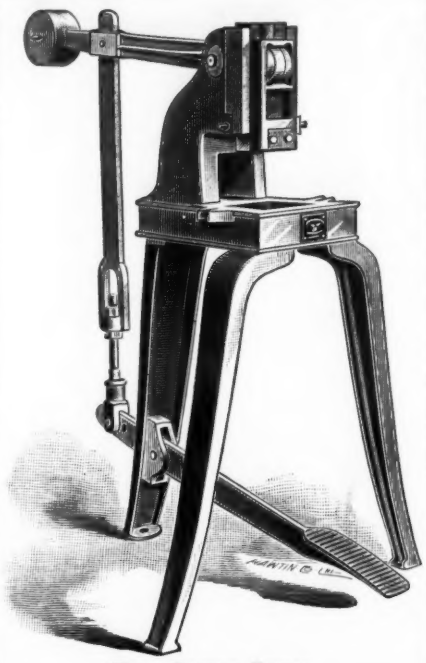
solid plank floors laid across timber beams at a distance of eight feet or more between centers, and the improvements in fire apparatus, particularly automatic sprinklers, has been that the cost of insurance in cotton mills has been reduced from two and one-half per cent. to less than one-fifth of one per cent., and this reduction of the cost of insurance has also been accompanied by an economy in the cost of the buildings and greater convenience for manufacturing purposes.

Foot Power Press.

The accompanying illustration is of a foot power press designed for all kinds of sheet metal work for which such presses are usually employed. It will punch to the center of a 10″ circle. The head is provided with collar screws on each side for the attachment of strippers, so that everything is clear below for handling wide sheets.

The slide has a steel gib and can be adjusted, and there is an opening through which the main lever projects. This lever carries a roll which moves the slide with little friction. Counterweight is adjustable on the lever. The opening in the bed is 5″x 6″; greatest distance from bed to slide, 6½″. The machine weighs, complete, 500 pounds. The bolster and necessary bolts, wrenches, etc., accompany it.

It is made by the Iowa Machine, Novelty and Brass Works, 88 East Walnut street, Des Moines, Iowa.



FOOT POWER PRESS.

Standard Measurements in Machine Construction.*

BY FRED J. MILLER.

(*Concluded.*)

I have made a test of this matter, using a small and delicate pair of inside calipers which I made and used for some years in the shop. As you see, they are of the common jointed type, but are small and light, weighing in fact less than ½ an ounce. It is, I think, a common mistake to make such calipers too large and heavy, and for nice work in transferring sizes from a micrometer caliper or other standard measuring device, it cannot be too much emphasized that such calipers should be light and delicate, in order that the slightest contact may be felt.

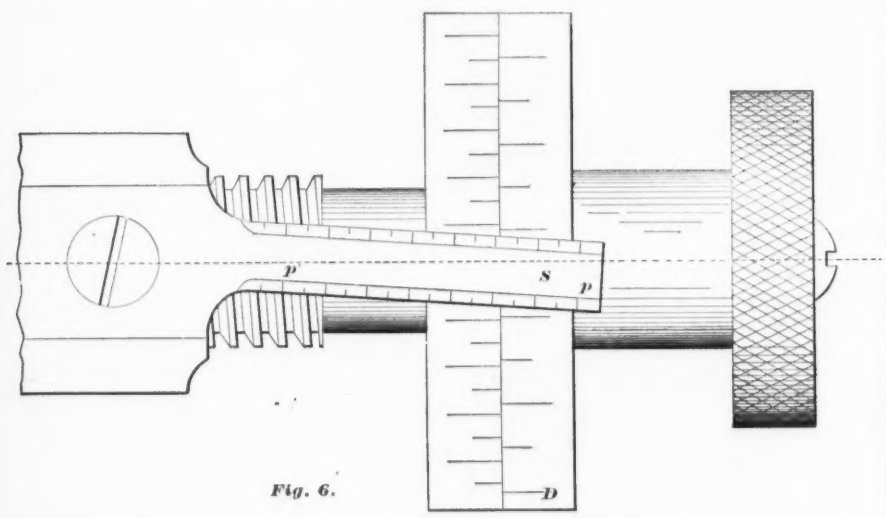


Fig. 6.

Placing a 2″ steel rule with one end against a block of steel, I rested one leg of the calipers against this block and adjusted the other to various sizes marked on the scale, using for the purpose a magnifying glass, and taking pains to set the calipers as accurately as possible. I set them to five different sizes, varying from each other by eighths of an inch, from ½″ to 1″ inclusive. After each setting I measured and determined the variation from correct size by means of this 1″ micrometer caliper, one of the latest productions of the Brown & Sharpe Mfg. Co., and obtained the following results.

1″	.99925″	— .00075″
7/8″	.8765″	+ .0015″
5/8″	.774″	— .001″
3/8″	.6245″	— .0005″
1/8″	.5″	

* From a lecture delivered at the Young Men's Institute, New York City.

The figures in the first column being the nominal sizes measured, those in the second column the actual sizes, the micrometer showed the inside calipers to be set to, read by estimation to the nearest ten-thousandth of an inch, and the third column the variation from correct size, the signs preceding these figures indicating the direction of the error. It will be seen that the greatest error was .0015″, the smallest .0005″, and that there is between the ⅞″ and the ⅜″ settings a total error of .0025″. Only one setting was just right. The smallest of these variations is sufficient to make the difference between a good fit and a poor one, as we have already seen, and it is to be noted that, in making the test, more pains were taken than would be taken in ordinary shop practice.

The only way, therefore, in which a shop could maintain uniform sizes, was by making for itself collars or plugs, representing sizes which could be kept for the purpose of reference and for setting calipers to. But by this plan the sizes of no two shops could possibly agree, and some of the shops in this country, whose proprietors at the time of which I speak recognized the importance of standards which were standards, imported them from the establishment of Sir Joseph Whitworth, in England, at that time the only maker of such standards. It was found, however, that different sets of these did not precisely agree—a discovery which, of course, was very damaging to the faith reposed in them. The firm of William Sellers & Co. were among those who imported such sets, and procuring two different sets at different times found them not to agree within the limit of close fitting and good work, although the first set had certainly not been injured by use, as it had been used only as a reference by which to make other gauges for use in their shops. Whitworth gauges are, of course, better now, and it is quite certain, as we have seen, that those produced in this country are at least sufficiently accurate for all practical purposes, and that their limit of variation is so small as to make it extremely unlikely that any further refinements which may possibly be introduced will disturb the standard, or make necessary any revision of the work now being done with reference to it.

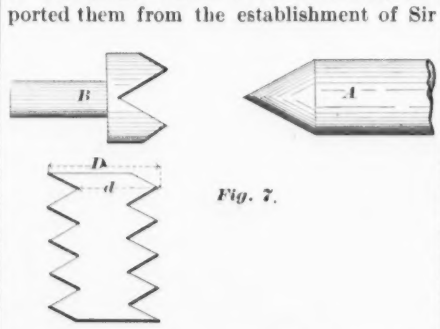


Fig. 7.

For the accurate measurements now made in shops, ruled lines are almost entirely dispensed with, and micrometer calipers or gauges are used instead. A micrometer screw is simply a screw having graduations upon some part of it, by which revolutions or fractions of a revolution of the screw can be accurately determined. Such screws were used for other purposes long before their application to calipers for machine shop use, especially upon astronomical and other scientific instruments. I have here one of the latest forms as now used for measuring up to 1″ diameter. (Brown & Sharpe Mfg. Co.'s 1″ micrometer.) It has a screw having 40 threads to the inch, so that, if it be turned one complete revolution, the screw advances 1/40 of an inch. This cylinder which is attached to the screw has around it 25 lines or graduations, so that, if moved from one graduation to the next one, the screw revolves 1/25 part of a complete turn, and consequently, of course, advances 1/25 part of 1/40 of an inch, which is 1/1000 of an inch, and as the graduations are about 1/16 of an inch apart, half or quarter thousandths, and even less, are easily read by estimation, and within very small limits of variation.

Fig. 8.

Here is a larger micrometer caliper (Fig. 5 illustrated January 7), designed by Prof. John E. Sweet, of Syracuse, and made by the Syracuse Twist Drill Co., to whose kindness we are indebted for the privilege of inspecting it, and testing its accuracy. It is designed to measure sizes from zero to 4″, though the screw has a movement of 1″ only, the back stop being adjustable for measuring magnitudes beyond that amount, standard end measure pieces being used in setting it.

The screw and nut in this caliper are of equal length, the object of this being to avoid trouble from local or periodic errors which may be present in the screw, and also to insure that the wear resulting from use shall be equally distributed over the entire length of screw and nut. The thread is not of the V pattern, but is square or radial at the back side—the side upon which the accuracy of the measurements depends. The screw is turned by this knurled disk, which is not fastened directly to it, but turns it by friction, which, by means of an adjustable spring, can be made just sufficient to overcome the friction of the screw in the nut, so that, upon meeting any obstruction, the screw stops, and thus inexperienced or careless persons are effectually prevented from forcing the screw up so tightly as to strain the tool, and injure it, or vitiate the accuracy of the measurements. In setting the back stop by means of the end measure pieces, it may not at times be easy to so set it that the proper contact will be obtained, when the scales read zero, and, to provide for this, the lineal scale is attached to the frame in such a way that it may be turned about the graduated disk until it reads zero, moving upon a thread of the same pitch as that of the measuring screw, so that the proper relation of the lineal scale is not disturbed.

It has not yet been found practicable to produce screws having exactly a predetermined pitch. All screws have at least some error, though in a few cases screws have been made that were very nearly exact. If exactly correct screws could easily be made, and then kept correct in use, the problem of exact standard measurements by micrometer gauges would be much simplified; but since this cannot, so far, be done, the next best thing is to devise a means of readily overcoming errors arising from inexact screws. To Prof. Sweet is due the credit of overcoming this difficulty, which has been and is so important in connection with the use of micrometer calipers, that I have prepared a sketch, Fig. 6, which I hope will enable those of you who have never investigated the matter to readily understand it. The sketch represents a plan view of the graduated disk, lineal scale, etc., of the caliper. The graduations on the disk (*D*) are read at the edge of the scale (*S*), and if the screw is exactly correct in pitch, *i. e.*, so that just 10 revolutions advance it exactly 1″, then the edges of the scale are straight and parallel with the screw; but if there is an error in the screw then the scale is placed at such an angle as to compensate for the error. I have exaggerated the angularity in this case to make it more easily apparent, and it will be seen that, in advancing the screw just 1″, the graduated disk (*D*) would move along from the point *p* to the point *p'*, and supposing the contact points of the caliper to be just 1″ apart when the scale reads zero at the outer end of scale, and to be together when it reads zero at the inner end, it is evident that the screw has made more than 10 revolutions by the amount of the angularity, the direction of the angularity in this case being that required for a screw too fine in pitch, or with slightly more than 10 threads per inch instead of precisely 10 threads per inch.

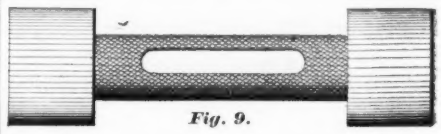


Fig. 9.

This principle of arranging the reading line at such an angle as to cause the screw to be revolved slightly more or less than the nominal number of revolutions called for by its nominal pitch has been applied in a great many different forms, and has proven exceedingly useful. That it is not understood by all who may become interested in standard measurements is shown by the fact that I found in the box with the caliper, upon its receipt, a small printed card, notifying the recipient not to change the scale, as it was placed at an angle for a purpose. The angle, I may say, is in this case quite perceptible, and indicates an error in the screw of about .001″.

The latest form which the micrometer caliper has taken is that for measuring screws, for which purpose the ordinary Brown & Sharpe caliper has the end of its measuring screw pointed, as shown by the sketch, Fig. 7, at *A*, while the other contact point, or anvil, as it is sometimes called, is replaced by a swiveling V block (*B*), which passes over a thread on the opposite side of the screw. The object of this arrangement is to enable measurements to be taken from the sides of the threads, where, indeed, all measurements of screw threads should be taken, and in reading the micrometer the depth of one thread must be subtracted from the outside diameter of the screw. This seems to give what tool makers have long desired, *i. e.*, a reliable and practical method of securing screws of standard diameter, and especially for making taps, and for other purposes where a slight variation from standard is necessary for practical reasons, and it is not practical to maintain

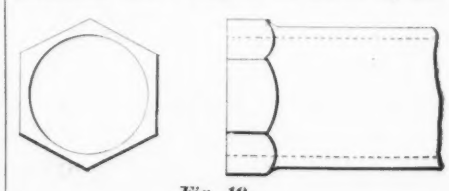


Fig. 10.

gauges, such a caliper should prove invaluable. The angles of the point of the screw *A*, and of the V in *B*, correspond to that of standard screw threads; *i. e*, they are 60°, and thus the contact is virtually on both sides of a space at one side of the screw and on both sides of a thread opposite. Since the caliper reads zero when the point of *A* is at the apex of the angle in *B*, their actual distance apart, when set to fit the threads of any screw, is equal to its actual outside diameter less the depth of the thread, and in the case of U. S. Standard threads the outside diameter, or *D*, will equal the reading of the micrometer, $d + \frac{.6495}{n}$, in which n equals the number of threads per inch. This, expressed as a formula, is $D = d + \frac{.6495}{n}$. For V threads the formula becomes $D = d + \frac{.866}{n}$.

Much trouble has, in time past, arisen from the lack of uniformity in screw threads, and especially has this been noticeable in railroad car repairs, for the reason that such repairs must be made at widely separated points, and it is highly important that the $\frac{5}{8}$ nut of a road in North Dakota, for instance, should fit a bolt of any New England

Fig. 11.

road, or, in fact, of any road whatever. It is, therefore, not surprising to find the mechanical officials of railways greatly interested in the question of standard sizes for bolts and nuts, and that some of the greatest triumphs of the art of measuring and of gauge making have been in connection with efforts to abate the nuisance of such profanity-provoking things as bolts "$\frac{5}{8}$ and a thirty-second full," or nuts "half inch scant."

I have here (Fig. 8) two gauges for a $\frac{15}{16}$" screw and nut. By a highly refined process, devised and used in the establishment of the Pratt & Whitney Company, they are ground out in the threads after being hardened, so that, though very hard, they are extremely accurate as to pitch, angle of thread and diameter, the sides of the threads being beautifully finished by the grinding operation. With a set of these gauges a shop can refer all taps and dies to them and be sure that its screws, bolts and nuts are correct. The sizes are derived from measurements made by the comparator before referred to; and, referring to Prof. Rogers' connection with this machine, and its use in connection with standard bolts, Mr. M. N. Forney once said: "It is worthy of note that a remedy for the evil complained of by master car builders, that nuts made by some firms or at some shops would not screw on bolts made at others, at first baffled the ability of the most prominent manufacturers of tools of precision in the country, and that to provide an adequate remedy it was necessary to secure the assistance of the highest scientific ability in the country, which was supplied through the Professor of Astronomy of the oldest and most noted institution of learning in the land. The man of science turned his attention from the planets and the measurement of distances counted by millions of miles, to listen to the imprecation, perhaps, of the humble car repairer lying on his back and swearing because a $\frac{5}{8}$ nut—'a leetle small'—will not screw on a bolt a 'trifle large.'"

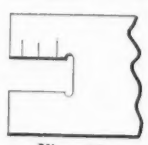


Fig. 12.

This matter of the interchangeability of machine parts is a most vital one to manufacturing interests, and when I say it is important to manufacturing interests, I virtually say at the same time that it is of vital importance to all so-called interests, and, broadly speaking, to the interests of humanity and of civilization. For I believe that we hear too much of special interests, as though the best interests of a certain group of men or persons could by any possibility be separated or even distinguished from the best interests of their compatriots.

Interchangeability means widely different things to different people, and the different parts of structures will interchange for various reasons. The bricks which compose the walls of a building are interchangeable, mainly because there is a wide limit of variation; the only result of one brick being somewhat larger than another would be that the soft mortar between them would be made thinner or thicker by the bricklayer in bringing the brick to the line.

Stove lids of a given stove are interchangeable, and it would manifestly be very inconvenient if they were not; for, in that case, if two or more of them were removed at the same time, pains would have to be taken to get each one back into its own particular place; and they are easily made interchangeable, because they need not fit tightly, and can consequently vary in size considerably, yet interchange.

Another, and a different case, is seen in the tongued and grooved boards used for flooring and similar purposes. These interchange and yet fit closely, but the maintenance of sizes need not be so very difficult, because the material is comparatively soft and yielding, and if the tongue of one board fits more or less tightly in the groove of its neighbor, a few blows of the heavy hammer used drives them together without much regard to variations, even though they may amount to considerable.

But to the machinist and tool maker, interchangeability means something entirely different from this; for, as we have seen, much less than a thousandth part of an inch will make the difference between a very close and quite a loose fit. This is, of course, owing to the comparatively hard materials worked, and, as we should expect, the difficulty of making work satisfactorily interchangeable increases with the hardness of the metal used, with the smoothness and roundness of the holes to which shafts, etc., are fitted, and the degree of nicety required in the fitting of the finished machine.

In making work interchangeable, it is customary to first build a model machine in which all the parts are adjusted and fitted to each other, as in the judgment of good mechanics they should be adjusted and fitted. Previous or analogous experience showing how much it is safe for any part of this machine to vary from the size as made in the model, limit gauges are then made which confine the variation within these limits.

I have here a limit gauge (Fig. 9) used in the shops of the Brown & Sharpe Mfg. Co., and designed to keep the variation of a series of holes within a predetermined limit. The nominal size of the gauge as marked upon it is $1\frac{5}{8}$", but neither end of it is just that size, one end being .001" smaller, while the other end is .001" larger. Holes such as this, in the piece shown at Fig. 10, must then be bored, so that the smaller end of the gauge will go in freely, thus insuring that the hole is at least not as much as .001" smaller than the standard size; the larger end must not go in, as you see this does not, and thus we are assured that the hole is not so much as .001" larger than standard size, and so we know that the variation of any hole cannot be so much as .001" from the standard either way, and that no two holes can vary from each other as much as .002".

The limit of variation is often much less than this, and, on the other hand, is often much greater, depending upon the requirements.

Other gauges are used for sizing shafts, those coming from the same establishment being simply flat plates of forged steel with openings at each end, having parallel sides which are finished by grinding and lapping after hardening. A form of this gauge, made by the American Standard Gauge and Tool Co., is seen here (Fig. 11). The same principles govern its use as those explained in connection with the limit gauge for holes (Fig. 9), the gauges made by this concern being made, I believe, of steel castings of such a grade that the contact surfaces can be, and are hardened.

Another sort of limit gauge is shown here (Fig. 12), in which the opening, instead of being parallel, *i. e*, the same width from front to back, is tapered, being at about the middle of its depth standard size, at which point there is a mark to which, if the piece is just standard diameter, it will just pass, while if smaller it will pass in further, and if larger, not so far, marks being placed at either side of the central one to indicate the limits of variation either way, which, in this case, is

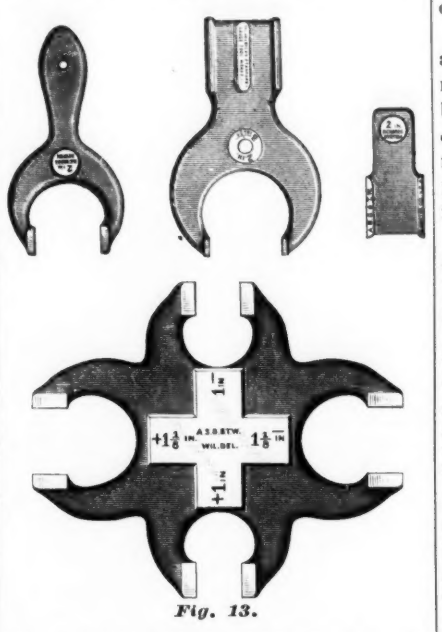


Fig. 13.

.001". Other forms of gauges made by the American Standard Gauge and Tool Works are shown in Fig. 13, these being standard gauges.

These may seem like small matters, and yet it is certain that the acknowledged preeminence of American mechanics and manufacturers in certain lines of work rests upon this matter of a standard inch, and of keeping variations within a certain predetermined amount stated in tenths of thousandths of inches; for it is to be remembered that this is far more than a mere question of facility in putting work together, or of convenience in obtaining new parts when breakages or undue wear take place.

Interchangeability permits and even compels a system of manufacturing, which, when once thoroughly installed, is far cheaper than any other. And it is being better understood every day that manufactories such as turn out watches, small arms, sewing machines, typewriters, etc., are not the only ones in which standard sizes pay, but that they also pay in all other shops making machinery of any kind. And I think probably this is better understood in this country than elsewhere. The firm which made this gauge (The Brown & Sharpe Mfg. Co.) had an extensive exhibit of machine tools at the Paris

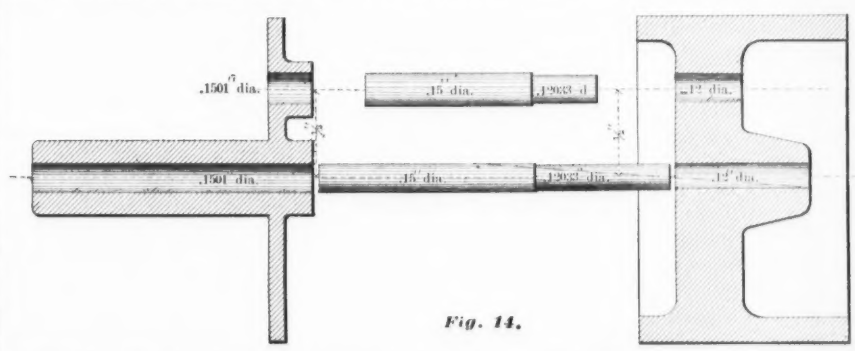


Fig. 14.

exhibition. Their representative there was not an American. After the machinery arrived it became necessary, on account of a change in its location, to remove all the countershafts, or "overhead works," as they are called over there. In doing this, the Paris representative was particular to place every tight and loose pulley and journal box on the floor together in just the same relative position as they had occupied, and which he, of course, supposed it was vitally necessary they should occupy. Imagine his dismay upon returning, after a short absence, to find that all the pulleys, boxes and shafts had been moved to another part of the floor, and hopelessly mixed. But again imagine his surprise and delight when he found that this made no difference whatever; for, by the use of such limit gauges as here shown, the variations from standard sizes of all pulleys, shafts and boxes had been kept well within the requirements of good workmanship, and it made no difference whether a certain pulley or box went back where it came from or not, so long as one of the same nominal dimensions went in its place. The discovery that this was the case was a remarkable one to him, and was made much of in setting forth the virtues of the machinery under his charge.

Yet these countershaft pulleys were not, I am confident, made interchangeable for the mere sake of interchangeability, but because by making them within the prescribed limits of variation they were generally better and more cheaply made than would have been possible with any other plan of manufacture.

A very ingenious application of the principle of the taper limit gauge was employed by Mr. John J. Grant, at the works of the Simonds Rolling Machine Company, in gauging steel balls, such as are used in bicycles and for other anti-friction bearings. These are ground true after hardening, and it is important that there should be very little variation between different balls of the same nominal diameter. Two hardened and ground straight-edges were placed near together, but with their edges not quite parallel, in such a way as to form a taper limit gauge, the exact diameter being at the middle of their length. These were inclined, the smallest end at the top, and, upon a ball being placed upon them, it would roll downwards until it came to a part of the opening just sufficient to let it pass through. If the ball was too small it would drop through before it reached the middle of the straight-edges, and would fall into a box with other balls that were too small. If too large, it passed the middle, and fell into a box placed to receive it and all others too large, only those which were within the prescribed limit of variation passing through at such points as to drop into the box intended for those of the proper size. It was two or three years ago that I visited the works, and, selecting at random from the stock a number of balls, I brought them away as interesting specimens of work. Among them were these now here, and, while preparing for this evening's infliction, I tested several of them by the gauges loaned me for the evening, and have found them surprisingly accurate, whether tested by the gauges of one maker or by those of another, showing not alone close work upon the balls themselves, but the substantial agreement of all the standard gauges as well.

To me the subject of gauging is an intensely interesting one, and there is very much more pertaining to it that I should like to present to you, but fearing that your patience will not hold out for much longer, I will close by citing a case which is considered to be an exemplification of what can be done in the best shop practice of this country at the present time. This job of work (illustrated by Fig. 14) consists of two pieces of steel having holes through them for the reception of the steel pins shown, the diameters of holes and pins being as marked, and the distance between the holes being $\frac{1}{2}$". The smaller portions of the pins are .00033", or one-third of a thousandth larger than the holes in the piece at the right, this amount being allowed for driving or pressing the pins into their places tightly. The larger portions of the pins are .0001", or one-tenth of a thousandth of an inch smaller than the holes in the piece at the left, this

being the allowance for an easy working or sliding fit. Now, of course, it will be seen that not only these various sizes, but also the distance between the holes in the two pieces must be very accurate in order to make a success of the job, and that the alignment of the holes must be practically perfect. It would require a high grade of workmanship in any man who should make these pieces and have them go together properly; but when I tell you that the piece at the left was made by Paul Simon, working in the shops of the American Watch Tool Co., at Waltham, while the piece at the right was made by George W. Bowers, and the pins by E. A. Mansfield, in the shops of the Franklin Typewriter Co., in Boston—no comparison either of work or tools being made until the completion of the work—those of you who are familiar with what this signifies will appreciate the extreme refinement of the workmanship. The object in doing the work in this manner was simply to save time, Brown & Sharpe micrometer calipers being used for measuring, which had never been compared directly with each other.

The exact location of the holes, I may say, was accomplished by having upon the spindle of a fine and accurate lathe a face-plate made as true as possible, *i. e.*, with its surface as nearly as practicable a plane, at right angles to the center line of the spindle. Upon this surface-plate was mounted another plate, also quite true. This second face-plate being clamped upon the other, a true hole was bored through it, to which was fitted a pin which projected from it and fitted also one of the holes in the work. The work being placed upon this pin, and clamped in such a way as to avoid springing it, the second plate with its pin was set over to such an eccentricity as to carry the work over the proper amount to give the required distance between the two holes, and the second hole was then bored in the work, the parallelism of the two holes being insured by the truth of the surfaces of the two plates, which, of course, made it possible to know that the movement of the secondary plate upon the primary one should take place at exact right angles to the spindle, and consequently to the holes bored. And, of course, if this movement be at right angles to both the holes, then the holes must be parallel to each other. It only remained, to insure the success of the job, that the movement of the plates—the one at Waltham and the other at Boston—should be precisely equal, or, in other words, that an inch, or any fractional part of an inch, should mean the same thing in Waltham as in Boston—a condition which was perfectly fulfilled by means of such tools as we have this evening been examining.

Coal.

Men can corner coal by limiting the supply and thus maintaining high prices, but they cannot control the weather. If they could we should have a coal dealers' winter that would make your ears crack off and freeze the breath in your throat.

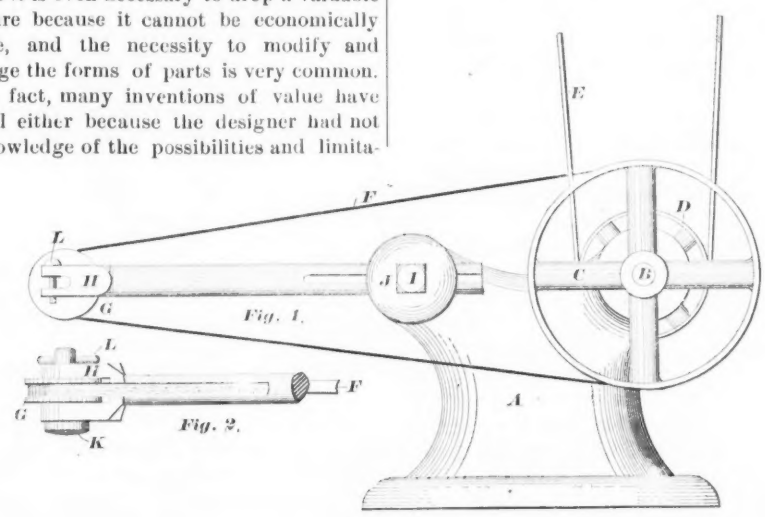
The weather this winter, we are told, has not suited the coal monopolists at all (which is really too bad, for it shows disrespect on the part of the weather), and many cars loaded with their commodity are now sidetracked along the various lines which supply this market. The open winter is bad for influenza, but favorable for the poor, who buy coal by the bushel, and even by the dishpanful. But while there is less coal being used, there is no change in the price. The monopolists are strong, and they propose to keep up the price, even though coal accumulates on their hands and they lose money, until a cold snap comes to their relief. This is a blemish on civilization, but it probably cannot be removed. It is wrong that a commodity which exists in such large quantities in this country should remain in the grasp of a monopoly, to which every one who uses coal is obliged to pay a royalty. The only outlet seems to be in a hope that the mechanical ingenuity of our people will furnish a substitute for coal, so that the masses may have a cheap fuel for heating and cooking. Some people believe that natural gas will eventually be brought here in pipes, the same as crude oil is now, and will be adapted to heating, lighting, cooking and manufacturing purposes. It may be, however, that the deliverance from the coal monopolists will come through electricity, which has already conferred such multifarious benefits upon the people. The supplying of a substitute for coal will be no greater achievement than others which have been chronicled during the past few years. Still there is no guarantee that, whatever form the substitute may take, it will not, like the coal, be seized upon and cornered.—*Jersey City Evening Journal.*

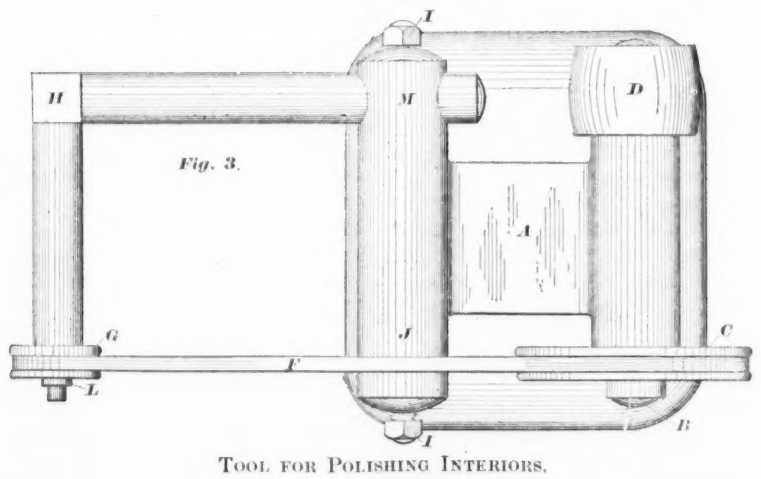
Tool for Polishing Interiors.

BY A. D. PENTZ.

In modern designing, sometimes as much ingenuity must be exercised to adapt the manufacture to the possibilities of tools as is manifested in the article itself. Sometimes it is even necessary to drop a valuable feature because it cannot be economically made, and the necessity to modify and change the forms of parts is very common.

In fact, many inventions of value have failed either because the designer had not a knowledge of the possibilities and limitations of tools, and failed to consult with those who had knowledge of that kind to dispose of, or he did not profit by such knowledge if he obtained it.





TOOL FOR POLISHING INTERIORS.

A designer, whether he be a tool maker or not, should be in frequent consultation with both the person who is to design the tools which are to manufacture the article he is laying out the models for, and the person who is to superintend the use of the tools in the manufacture of them.

These three, if harmonious, and it is to the interest of each to be so, make a committee of ways and means that should be able to manufacture a meritorious article, and make a success of it. The effort should be, first, to eliminate hand work; second, to reduce operations to the fewest; third, to simplify difficult operations, and, over all, to make work that will duplicate practically, and be what it pretends to be. The designer will doubtless have to change a shape here and there, or drop a pet notion, to accommodate the practical side of manufacture; and it is a fact, attested by a hundred incidents in my experience, that valuable inventions and improvements often come to a designer in an effort to put his work into the factory to suit the building element and tools. The tool maker may be obliged to design new tools which will be a credit to him ever after. It is not unlikely that he may get suggestions from the other two, that will, if he accepts them, be of use to him. The builder, who is always conservative, will be forced to accept new methods, to drop antiquated ones, and to do by tools that which he is habituated to do by hand.

The demand of modern design on modern tool makers has largely been the cause of the improvement in modern small tools. No valuable feature in an invention or design should be dropped before it is shown that a tool cannot be designed to make it, or that it cannot be modified so as to be machined on a tool possible to be made.

Tool makers may always, with profit, consult with men who have designed ingenious machines or other devices. A man who has ideas is as likely to think straight on tools as on other things. The men who do the best work of any kind do not radiate ideas of their own as frequently as they do those of others, which they have assimilated.

Ornamentation and finish are now so generally used on all kinds of articles, that he who designs must study the beautiful, and he who must finish must either have tools to finish with, finish by hand, or have the article changed so that it can be finished.

Electro-plating demands more finish than was dreamed of twenty-five years ago, or before it became so common. It is a merciless inspector of polished work, because it magnifies every scratch. In designing for plated work, holes are avoided, because of the difficulty in polishing them. Round holes are easily polished, but irregular holes are not, and are not often permitted in plated work.

To provide a tool for polishing irregular holes, I have enlarged on a crude contrivance made by me in Chicago in 1873. This was a small affair, for very small holes, but it did well. It has been an idea with me that I might be able to do something with it some time.

Fig. 1 is an elevation showing the polishing belt and the means to drive it. Fig. 2 is a part of the plan of Fig. 1, showing that the belt can be thrust into a hole of reasonable size, without any adjustment or stopping of the machine. Fig. 3 is a plan view of Fig. 1, but showing a different arrangement of some parts.

The stock *A* is a hollow casting having a long bearing for the shaft *B*, and two hubs, *J* and M, for the extension arms. The pulley *C* is driven by the shaft *B*, which in turn is driven by the pulley *D*, both of which are securely attached to the said shaft. It is of advantage to have the pulley *C* quite large, and the pulley *G* as small as possible.

The stock *A* is to be bolted through its base to a bench or stand of solid and rigid character, so that the polishing belt *F* may have a convenient height and not vibrate. The extension hubs *M* and *J* are bored to receive the extension arms *H*, and are provided each with a set screw *I*, so that the extension arms may be adjusted, and when suitably located they may be secured.

The small pulley *G* is attached to the end of the extension *H*. This extension arm is shown in two forms, for accommodating various kinds of polishing operations. The pulley *G* is shown with three different methods of attachment to the extension arm *H*. In Fig. 1 it has a rigid axle, and it is held by cotters within two slots cut in the end of the extension arm. In Fig. 2 it revolves on the stud *K*, which is also secured within the modified extension arm *H* by the cotter *L*. Nuts are unsafe in such places, as they are soon shaken off.

The extension arm *H*, in Figs. 1 and 2, is arranged in direct line with the polishing belt, and it is entirely within the loop. This is of advantage in interiors, because there is no adjustment necessary. The hole, if of reasonable size, should pass over the pulley, etc., be polished with nothing to interfere on either side, and taken off without stopping the machine. I know of no existing belt arrangement with these advantages, and believe it to be a labor saving and quality-improving device.

The extension arm *H*, in Fig. 1, is held within the hub *J*, but the extension arm in Fig. 3 is held within the hub *M*, and has an elbow and supporting wrist, which places the pulley *G* in the proper position in line with the pulley *C*. If in this Fig. 3 the belt be left slack, smaller holes may be polished than in the arrangement in Figs. 1 and 2. The belt is taken from the pulley *G*, put through the hole to be polished, and returned to the pulley again. It is presumed that some practice will be necessary to keep control of the work. Again, if a half-round crossed belt be put on with the convex side out, a very small hole may be polished at the junction. Of course, if many like pieces are to be done, holding fixtures and handles would be made.

Drilling or ticking cloth, folded to the required thickness, and quilted on a sewing machine, makes the best belt, and holds glue better than leather.

We frequently have something to say regarding the mistakes made by the daily newspapers when treating mechanical subjects, but it must not be inferred that there are no mistakes to be found in technical papers, even when discussing subjects upon which they may wish to be considered authorities. We note an instance in a recent issue of a technical contemporary, where a transmission device interposed between pulleys and gear wheels is declared to "automatically absorb power from the driving pulleys, according to the load or amount of cut taken." Instead of absorption, transmission is, of course, meant, and it would be interesting to know how any transmission device could be arranged that would not automatically transmit power in proportion to the resistance encountered up to the limit of the power and strength of the machine. An ordinary gear wheel keyed to the shaft does just that.

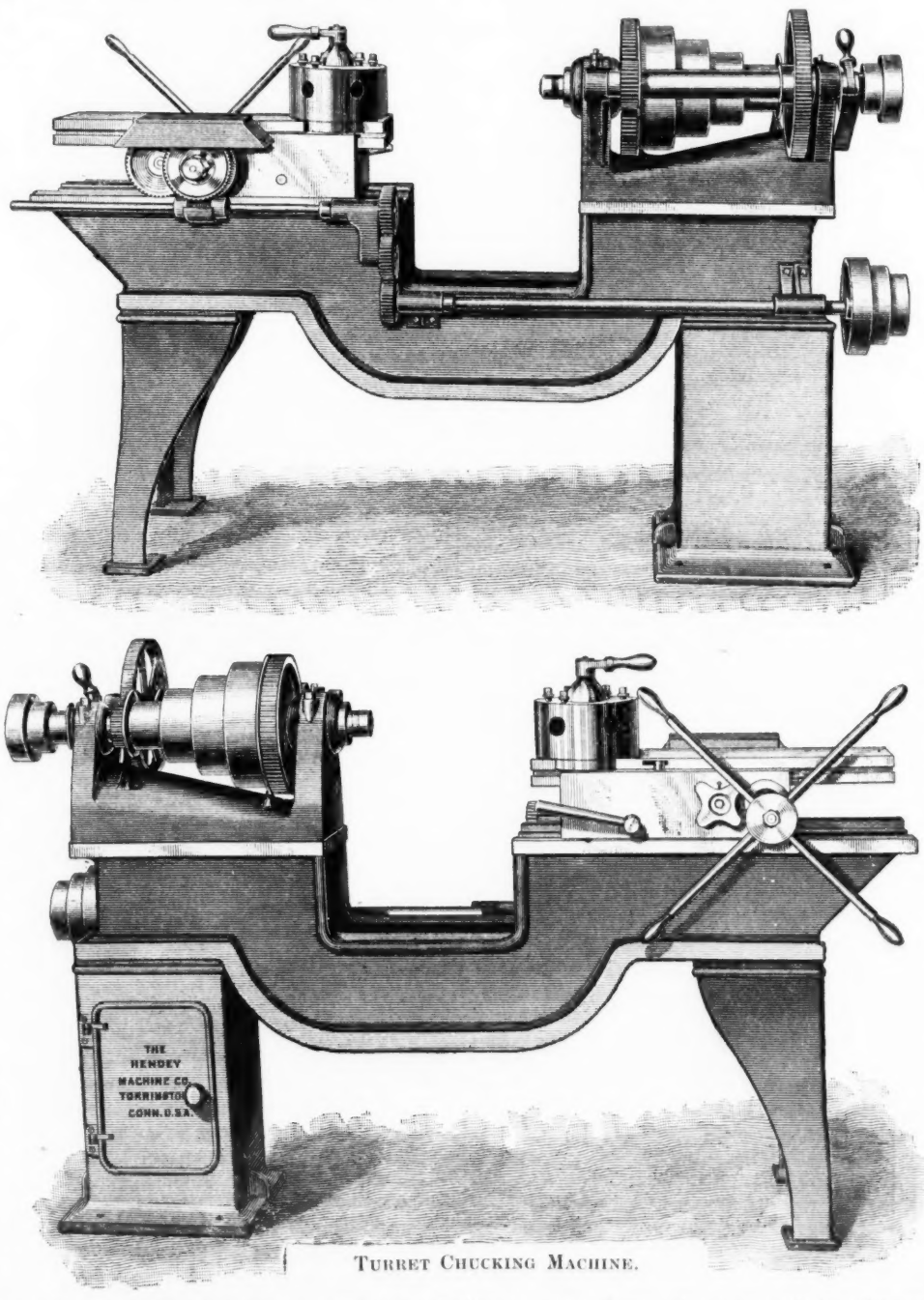
It is said that in the German Navy the efforts to signal by balloon have been entirely successful. Of course, this means not only signaling at sea, but on land as well. If the development of such a plan can be available for the arts of peace as well as for those of war, it will be a blessing.

One can hardly read a daily paper in these times without finding some city or town complaining of the lack of adequate fire protection. Numerous large fires of late emphasize the fact that this does not pay.

Turret Chucking Machine.

We give on this page front and rear views of a turret chucking machine recently brought out by the Hendey Machine Co., of Torrington, Conn. The main features of the machine will be readily understood from the engravings. The turret is 9″ diameter; has six 1½″ holes, in which the tools are held by key and screws, is automatically revolved by the backward motion of the slide, and has an automatic feed of 12″. The machine swings 20″ over the bed and 36″ through the gap, which is 16″ wide.

The cone is for a 3″ belt and the spindle, which runs in hard bronze bearings, has a 1¼″ hole through it. The machine, with six-foot bed, weighs about 1,800 pounds. It is made also without the gap when desired.



TURRET CHUCKING MACHINE.

In the death of General Meigs the army loses one of its foremost scientists. He was on the retired list at the time of his death. He was famous during the late unpleasantness as Quartermaster-General of the Northern Army, and he has at different times planned and superintended important military constructions.

Hammering Saws.

BY C. E. GRANDY.

THIRD PAPER.

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An opposite to a rim slack saw (that is, too much tension at the rim), is a center slack saw, or too much tension at the center.

This condition is known as too open; it would follow that, if sufficient speed were put on the saw, it would again be of the right tension while this speed was maintained.

To some extent this might be so, yet the speed would tend to expand the edge toward the center, equal in proportion to the size of the saw. It follows, then, that if a 50″ saw would become of the right tension that a much higher speed would be required for a 30″ saw. This, in most mills, is not practicable, for several reasons. Yet, nevertheless, this is done, when possible, many times successfully, but not as a rule. I have in mind a case where I changed a saw that was too large at the center from a slow arbor to a high-speed arbor, and whereas the saw would not do a good job on the slow-speed arbor, it did first-class work on the high-speed arbor, and gave no trouble.

Unfortunately, when a saw has become center slack, it is most always caused by some accident, as undue crowding against the plate causing it to heat and become set permanently, and this near the eye at the collar. Most log saw arbors have a 6″ or 7″ collar, and the enlarged circle of the plate is about 4″ out from the collar, or on a circle of 14″, or 7″ to 8″ out from the center. When this is so, the plate becomes what is known as dishing; that is, it is in the form of a dish or tin plate. When a saw begins to take on this condition, and is yet forced to the work, it soon becomes set and is played out for useful work. Just how to hammer a saw in this condition, so as to again restore it to proper tension, is a much more complicated question than the opposite, or a rim slack saw.

It is the first thing to find where from rim to center it is enlarged. This is known by a straight-edge test, by tipping the saw from a perpendicular resting on the floor, and supported by the hand of the operator, holding the straight-edge perpendicular to the saw, and tipping it with the plate. It will be noticed that the plate begins to fall away as soon as tipped from a perpendicular, and at some angle it will be just parallel to the straight-edge; that is, provided the tension is gradual from center to edge. But if it is not gradual the plate will fall away and touch at the edge and center, as perhaps the center will continue to be convex for a distance of say 10″ out, then hollow the rest of the way to the edge. This denotes that the undue tension is in the crowning part, and is so much so that it is set in that form. The first proceeding is to take this bend out by hammering on the wood block the part included in the 20″ circle to the collar circle, or near to the circle of the collar diameter. Continue this hammering until the bulged spot is down and will drop through with the rest of the plate. You can then spring the plate through as you would an oil can bottom; it will probably stay through unless it is again pushed back. I have seen this condition where the saw dished 2″, and could be pushed through.

The plate should be hammered at the extreme edge on a steel anvil, then in a circle 1″ in from the edge, then in a circle 2″ in, then 3″, then 4″, then test it by the drop, with the long straight-edge, as described in second paper. If the plate shows parallel with the long straight-edge you have the tension equal, and it is right for a speed of 600 revolutions for a 50″ saw. You should then hammer the saw at a quarter circle in from the edge; that is, if the saw is 50″ the circle should be a 40″ circle, from that to a 30″ circle, both sides alike, so the saw will drop from the edge to a circle of 40″, then be parallel the rest of the way across the center to the 40″ circle on the opposite side of the center. You must keep at this carefully, thoughtfully and persistently, until the right tension is shown. Then you will find that you have the plate full of lumps or round high and low places. This should be tested with the short straight-edge, and hammered down on the wood block. Then when you have the lumps or high and low places out so it is in a generally true plane, you must test with the long straight-edge for general trueness, and level the saw as described in second paper.

Your saw may develop a warp; that is, a twist, crowning one way and dishing the other. I will explain, later, how to remedy this.

LETTERS FROM PRACTICAL MEN.

Bushing an Engine Cylinder.

Editor American Machinist:

In your answer to Question 556 you advise George B. to bush his 8″ cylinder rather than to shorten the stroke. If the engine is automatic, as he says, the plan you advise will not pay the cost, in my opinion, and the opinion is based on an experiment in a practically parallel case. We bushed a 9″ cylinder to 6″, which made it right for the power required, and yet it required a little more coal than before. We allowed that the point overlooked was that the per cent of clearance was enormously increased by the change.

JOHN E. SWEET.

A Few Conundrums.

Editor American Machinist:

The following letter, which appeared as a communication in a recent issue of *Engineering* (London), may be of interest to readers of the AMERICAN MACHINIST:

SIR: Will some reader of *Engineering* please answer the following questions or say where a book can be procured which will give the information?

Suppose I have steam in a boiler at a pressure of 200 pounds per square inch above the atmosphere, and I wish to use this steam to *the very best possible advantage* in an engine to indicate say 1,000 horse-power.

Must I use one, two, three, four, or how many cylinders?

What will be the diameter and stroke of the first, second, third, fourth, etc., cylinder?

At what point ought the steam to be cut off in the first, the second, the third, the fourth, etc., cylinder?

Also the points of admission, release, and closing of eduction ports?

What will be the initial pressure, the average pressure, and the terminal pressure of the steam in each cylinder?

Must I steam jacket all or any of the cylinders?

Must the steam pass immediately by shortest route from cylinder to cylinder, or must there be receivers between?

Must I use a jet condenser, a surface condenser, an ejector condenser, or none at all?

Would the same proportions hold good to indicate say 20,000 horse-power or with steam at 100 pounds per square inch?

What would be the best piston speed?

What are the best books on the latest steam engine practice, illustrating and describing really modern engines, valve motions, governors, etc., so that an ordinary mechanical engineer can understand and make them? Yours truly,

H. F. J.

Evidently "H. F. J." is either not even an "ordinary" mechanical engineer, but simply one of the too numerous class of amateurs whose business appears to be the wasting of money to the discredit of the engineering profession, or else his letter is a lame attempt to obtain gratuitous information. In either case the letter might serve as a sort of examination paper for some of the younger readers of the AMERICAN MACHINIST, but it is safe to say that you would not be able to find space for their answers.

Possibly "H. F. J." can answer his conundrums to his own satisfaction after a careful study of Prof. Thurston's two-volume treatise on the steam engine. The writer has no intention of attempting to answer them, but if the attempt were made on the data furnished by "H. F. J." the answers would be largely sprinkled with *ifs*, and it is the necessity of these ifs which suggested this letter. "H. F. J." says that he wishes to use the steam "to *the very best possible advantage*." Now what does that mean? It may mean to get the maximum useful work from each pound, but it ought to mean to get the greatest amount of useful work for a dollar, and the answers may differ widely accordingly. Is this "steam in a boiler" wet, dry or superheated, and to what extent? How far is this hypothetical boiler from the 1,000 I. H. P. engine? Is this engine to pump water or drive dynamos, or what? Presumably the class of work would affect the design to some extent, even if made by an "ordinary" mechanical engineer. And is condensing water readily and cheaply obtainable or not? These are a few of the factors which the ordinary mechanical engineer must consider before beginning a design or copying one from one of "H. F. J.'s" comprehensive books.

The gist of the matter is that such communications should have no place in an engineering journal. In the first place, it is evident that several of the questions cannot be answered properly, for lack of data, and, in the second place, the commercial side of the problem, which is of the greatest importance, must be considered. The establishment of a triple-expansion condensing engine in the middle of an Illinois prairie, with coal at 50 cents a ton, and the only water that from drive wells, is not engineering, any more than it is to use slide valve non-condensing engines on the Pacific coast with coal at $9 per ton. Yet this commercial side of the problem—and all engineering questions figure down to a matter of dollars and cents in the long run—is apparently frequently lost sight of in engineering papers, with the result that the younger student readers have very little appreciation of such items as first cost, interest, depreciation, cost of operation and maintenance, the money value of fuel saved, cost of condensing water, etc.

ARTHUR T. WOODS.

St. Louis, Mo.,

"Grinding in American Workshops."

Editor American Machinist.

Being a little behindhand with my reading, I have only just seen your article on

"Grinding in American Workshops," in your issue of December 3d. In that number you give a quotation from English papers about my address before the Manchester Association of Engineers. There have been so many misstatements in these various reports that an attempt to correct them would have been hopeless; but as you reprint one of these misstatements I must ask you to correctit, for my American friends' sake who were so kind in showing me through their workshops.

Delivering my address, if there was one thing I was more anxious about than another, it was this, "that it should be clearly understood that I was not going to speak of American practice in general, for about that I know nothing." Several times I repeated that I would only give an account of what I saw when visiting some of the *best* American workshops. To pick holes into other people's bad ways would be of no interest or profit to any one.

One of these *best shops* was the *Brown & Sharpe Mfg. Co.'s works*, and there I saw grinding operations carried on to an extent that I for one have never thought possible or profitable. By a daily visit during a whole week, which the kindness of Mr. Sharpe enabled me to make to these works, I was convinced that a great deal of work which is generally done on a lathe by skilled turners may be done much better and more expeditiously upon their universal or plain grinding machines.

The turning fraternity need not be afraid of the grinder. There is no doubt but that there are certain kinds of work which can only be done on the lathe, but a great many other kinds of work, if done on the grinding machine, would greatly benefit the master's pocket, and in the long run the turner too.

There need exist no jealousy between the turner and the grinder; each one has his proper sphere and use, and Darwin's theory of evolution is working in the engineers' workshops as well as in nature, and the grinding of both circular and flat surfaces is undoubtedly such an evolution development from work formerly done on the lathe, the planing, shaping and milling machines.

"Everything has its use, and a proper use should be made of everything."

Manchester, Eng. HANS RENOLD.

[It should be remembered that in our article referred to by Mr. Renold we were not criticising anything said by him, but what was said by another in discussing his paper at the time of its being read, and the comments upon the paper and upon the discussion of it by one of our English contemporaries, *The Mechanical World*. We did not think that Mr. Renold's paper justified the conclusion by his hearers, that finishing by grinding was the universal practice here; but nevertheless this conclusion seemed to have been formed, and in explaining this imaginary state of things "a leading machine maker," in his apparent anxiety to show that we could not possibly excel here in any particular, made some very ridiculous statements. These statements, and the serious treatment of them by our contemporary, amused us somewhat, and we thought to give our readers an opportunity of enjoying their unconscious humor.—ED.]

Critical Notes.

RAISING A PLANER TOOL WHEN REVERSED —LATHE CENTERS—QUESTION 573.

Editor American Machinist:

It is a late day to do so, but I wish to thank Mr. Trask for calling the attention of your readers to the mistake in the illustration and description of a method of keeping a planer tool from rubbing on the work when reversing, which I contributed to the August 6th number of the AMERICAN MACHINIST. The device described consisted of a piece of leather tied to the back of the tool, and the cut showed the leather so short that it would break the point of the tool as it dropped down ready for the next cut.

This incident shows how liable a person is to err in observing a process, and also the advantage the practical man has over all others in describing methods from personal experience. As I had never used the device, but had only seen it used by others, I committed the common error of supposing I knew all about it.

Mr. Pentz gives some very practical ideas on lathe centers, and refers to a method of making cast iron arbors with steel centers. Cast iron is a good and cheap material for arbors, and with the use of steel centers is as durable as any other kind if properly made and used, but the method of inserting the steel centers is not so good as one I have seen used. Tapering holes were bored in each end of the mandrel, and the steel center pieces were well fitted into the holes by turning and grinding to a fit with emery and oil, after which the pieces were cut off the proper length, centered and hardened on the end only where the center was, and then driven firmly into position. A hole drilled through the mandrel, just at the small end of the center piece, provided a means of getting it out with a taper drift, so that it could be repaired or replaced by another if needed.

J. H. B.—Question 573—seems sorely in need of information regarding a device he proposes to use to operate the valve for reversing the motion of an engine in a rolling-mill. I have tried a cylinder for that purpose on a 20″x30″ engine, and it was not a practical success. It is a well-known fact that it takes more force to overcome the friction of a body when at rest than it does to keep it in motion when started, and this is the chief trouble with a steam cylinder for operating the valve. When steam is turned on to move the valve it starts with a jerk, and the expansive effect of the steam carries it too far, and makes it impossible for the operator to get proper control of the valve, which he must have when reversing an engine for such a purpose. Another objection to the device is that it is not used often enough to keep it in good working order, and when wanted is likely to have the valves or piston rusted or gummed so it will not start promptly. Also, it takes time to detach the eccentric rod and attach the reversing cylinder connection to the valve gear, and in many cases that is objectionable, although it may not be in this instance.

Very frequently around rolling-mills hydraulic pressure is available, and if J. H. B. can use that it will be much more suitable than steam, for it will give a positive motion, and with pipes and valve of proper area will give as rapid a motion as is needed. If steam must be used, I would suggest that an oil cylinder be placed in line with the steam cylinder, with a piston on the same rod with a hole through the piston in the oil cylinder, so it will allow it to move only at the desired speed, with full steam pressure on.

I think the worm wheel arrangement would not be successful for such work, as it would be too slow if worked by hand, and it would need to be quite strong to reverse a roll train of a size that 20″x30″ engines would drive.

I think it would be best for J. H. B. to devise a reverse motion operated from the engine shaft in some manner. If there is not room on the engine shaft for another eccentric, it might be possible to use the same eccentric by elevating the eccentric rod high enough to neutralize the lap angle of the eccentric, and attach the rod to a rocker arm that would give a reverse motion to the valve. I would advise him to use the steam cylinder only as a last resort, and then with strong doubts of its utility.

BELL CRANK.

Wants to Know.

Editor American Machinist:

I am working upon a machine, the object of which is to produce a number of jets of fine spray. I wish to accomplish this by atomizing the liquid by a blast of air. Can any of the readers of the AMERICAN MACHINIST give me any information of the construction of nozzles which have been used for such purposes? I wish to know the size and shape of orifice, the manner in which the air and liquid are brought together, and the pressure of air used, and whether or not the liquid is raised by the air blast. Will the ordinary centrifugal blower give a sufficient pressure? The spray should reach from three to four feet from the end of the nozzle. If any one can give me any information on this point, or cite me to where I can get such information, I would be grateful.

H. L. REYNOLDS.

Marking Patented Articles.

Editor American Machinist:

In a recent issue you have an item in the editorial columns regarding the marking of patented articles. If you would refer to the patent laws, section 4,900, page 12, of the laws issued by the government, dated February, '81, you would see that it is not only necessary, in order to protect the patent, to put the word "patented" upon it, but the government states, "together with the day and year the patent was granted; or when, from the character of the article, this cannot be done, by fixing to it, or to the package wherein one or more of them is inclosed, a label containing the like notice," and providing that, if the patentee does not so mark, he cannot recover damages unless he can prove that he duly notified the manufacturer that there was such an infringement made by him.

WATSON & STILLMAN.

Something Mysterious About It.

Editor American Machinist:

The clipping below is from a daily newspaper published here, and is certainly worthy of the title "special," which title it has. The enterprising reporter, who thus calls attention to the tendency of "engine heads" to "fly off suddenly," while a first-class boiler explosion is in progress, ought to have a medal. The item is incomplete, in that it fails to state whether the boiler exploded first and was followed by the "engine head" flying off, or the engine head went first, thus setting a pernicious example to the boiler. The fact that it "flew off suddenly" is also so at variance with the best recognized customs on such occasions as to merit the severest condemnation. "Engine heads" must be made to keep their place in the procession, and not go off before the drop of the hat. "Look out for the engine head when the bell rings" would be an appropriate motto for an engine room.

Never mind the boilers, they are harmless and innocent compared with the deadly and destructive "engine head."

Some years ago the writer, in conversation with a newspaper man, heard the following: "It is surprising," said he, "how little the public know about the newspaper business." I think this might be transposed thus with justice: "It is surprising how little newspaper men know about *any* business."

"[Special.]—A boiler exploded last evening in the feed mill of Milan Perkins, at Holland, this county, killing John Adams, the engineer, and Floyd Perkins, the little son of the proprietor, and scalding and bruising Milan Perkins and Elliot, another son of the latter. The mill had just closed down and the men and boys were preparing to go to supper, when suddenly the engine head flew off. The engine house was scattered like chaff, and the bodies of the killed and injured with it. The damage to the mill is about $2,000, with no insurance. Coroner Roulet held an inquest this afternoon and gave a verdict that the explosion was purely accidental, no blame resting on anyone."

HENRY PENTON,
Chief Draftsman, Frontier Iron Works.
Detroit, Mich.

[We give the foregoing as an example of the way such things are generally handled by the daily press. We get numerous letters of the kind, which lack of space compels us to exclude. Once in a while one goes, as an interesting exhibit.—ED.]

Favors Short Belts.

Editor American Machinist:

In your issue of December 24th I think W. M. has hit the nail on the head regarding upright drilling machines. I bought one recently, and was particular to get one with the driving shaft up from the floor, as it is easier to get at to oil and clean, and shift the belt on and off the cone pulleys; in fact, it appears to me to be more economical to run a drill with a short vertical belt than with a long one. In the first place, it costs less for belting, as I think two belts, each ten feet long, will last longer than one belt twenty feet long. Of course, belts will stretch; a belt twenty feet long will stretch twice as much as one ten feet long, with the same power, thereby leaving the belt looser around the bottom pulley with long vertical belt than with short one. It might be claimed that the arc of contact of the belt with the pulley while running from the large to the small pulley of the cones, or *vice versa*, would be greater with the long than the short belt, but the difference would be very small in the ordinary drilling machine; if both the driver and driven pulleys were of the same size there would be no difference in this respect. The nearer together the pulleys, the better—at least such is my experience from a machine that I build.

ALBERT L. COLBURN.

Rusting of Steam Pipes.

Editor American Machinist:

I do not feel competent to say what may have caused the rusting in the steam pipes referred to by "An Engineer," but am quite sure about the facts in the case of my own plant; for of nine cases, all the leaks have been close to the end of the lengths, on the bottom and on the side of the joint from which the steam comes. They have also been several hundred feet away from the boilers, and where there is not any impact of steam or entrained water against the surface.

I have lately had a curious example of the latter action. It was where a ¼″ drip pipe from the bottom of a cylinder of an upright engine was tapped into the side of the exhaust pipe, and the leak occurred on the opposite side of the pipe where the steam and water impinged against the inside surface, and there was a space of several square inches eaten away and made thin by the alternate heating and cooling action of the condensed water and steam from the cylinder. When starting, quite cool water is ejected, but before the cock is closed steam equal in temperature to the initial pressure is being thrown against the same surface, and, of course, induces alternate expansion, contraction and erosion.

P. H. BULLOCK.

More About Steel.

Editor American Machinist:

I have been reading with interest Mr. Goodyear's remarks concerning steel, in your issue of December 17th. Mr. Goodyear always has something of interest to say, and it is clear that he has a long and intimate acquaintance with steel and iron.

That some of the points he makes are true I have evidence in my own experience. It appears to be a common belief that the value or endurance of steel, for other than structural purposes, is mainly determined by the proportion of carbon contained in some form, and many explanations are offered as to how carbon acts under various forms of treatment; also how much carbon is required to produce a given result.

Of two pieces of tool steel, one containing above two per cent. and the other less than one per cent. of carbon, used under precisely the same conditions, the lower carbon steel did the greater amount of work, and possessed other superior qualities. Just what effect heating and chilling had upon the carbon I will not go into now—merely stating that a fair degree of experience and skill were employed.

Steel does not always show a coarser fracture from annealing, nor do the wearing qualities depend entirely upon the amount of carbon contained. I have had chisels and lathe tools in use for a considerable time, the users of which were not aware that they are not of the best or usual grade of tool steel. Yet an analysis would differ greatly from the standard brands of tool steel. I

will add that this steel was not intended for use in tools.

I made in the year 1889 car wheels of cast-steel, which, judged by the usual standards, should have worn out before this date, having been in continuous use—in severe service—up to this time. As a fact, they have not yet been turned off for the first time.

An analysis would show nothing remarkable, nor is it probable that a precise knowledge as to how carbon acts in heating and chilling would contribute much towards producing the result.

It is clear that a metal is not steel because of possessing hardening properties, nor iron because of its not possessing such qualities, nor can a metal be called steel because of a high percentage of carbon, since pig-iron—cast-iron—contains more carbon than what is known as tool steel, although not wholly in the same state. W. G. RICHARDS.

About Keys.

Editor American Machinist:

I note with high pleasure in number of 3d inst., Topical Questions at the New York meeting of the Mechanical Engineers, and especially Mr. Ball's subject of keys, with accompanying sketch, which manner is familiar to me. The Holly Manufacturing Company, Lockport, N. Y., use this method, and as I have been with them over two years as engineer, erecting motive power, and in charge of work generally, I observed these keys giving excellent results.

GEO. N. FINLEY.

Twist Drill Grinders.

Editor American Machinist:

Allow me to thank you for your excellent article accompanying the publication of the cut of my Ideal Drill Grinder.

If you will allow a very little criticism of the article, it strikes me that your expression, that "there is less difficulty usually in getting a reasonably satisfactory performance from a hand-ground drill of small size than from one of larger diameter," though well worded and guarded, is not in exact accordance with workmen's experience.

Large drills from ½ inch upwards have a center line drawn in the groove, so that the workman can easily locate the point correctly, and the angle of the lips on the long lines of large drills can be more accurately determined by sight than the same on small drills, so that, as a rule, there will be less variation in proportion to size of hand-ground drills in large than in small sizes.

As a matter of fact, the most skill is required on the smaller drills. As far as my observation has extended, very few mechanics understand that twist drills, or, for that matter, any drill, requires a differential clearance from point to edge of lips.

I suggest this merely as a matter of practical mechanics, and probably worth treating in your editorial pages.

THOMAS HALL.

[The description of Mr. Hall's grinder was written by a man who is a workman, and who made the statement referred to because his own experience, and that of others, so far as he has had opportunity to learn it, seemed to point that way. It is the experience of the writer that, when accustomed to grinding small drills, one can, by having at hand a small plate of metal in which to try the drill, readily ascertain whether or not it will drill its size accurately; and when he has found that it will not, and he therefore knows positively that the lips are not alike, it is usually easy to tell where the drill requires correction. An analogous process we do not believe to be practicable with large drills, and the only other plan is to gauge the bevel, and, in the absence of the grinding line, measure the length of the lips. Either process, however, is crude and costly compared with the work done by a good twist drill grinder, and the fact is that, even supposing that twist drills could be ground by the average workman as well as they can be ground on a machine, it would still pay to employ the machines for the purpose, because by them it can be done more quickly, and with much less wastage of drills. Mr. Hall refers to the variation in proportion to size of drill. We are not sure that this should be considered, and are inclined to think it would be more nearly correct to consider the absolute variation. A one-sixteenth drill .001" loose would not be too loose in very many cases, but a one inch drill .016" loose would be too loose in most every case or kind of work.—ED.]

Cores for Molding Steam Cylinders in Dry Sand.

BY S. BOLLAND.

The subject of cores will now occupy our attention, and let me say here that too much importance cannot be attached to it, as too frequently we see disaster attend the using of cores for such work which have not been intelligently made.

Ordinary cores are not to be thought of for this class of work. The risk is too great; very many dry sand as well as loam molders refuse to use cores except those made by themselves, and unless the very best skill be employed to produce such cores, they are perfectly justified in the course they pursue.

It is my purpose, in describing how to make a set of cores for this cylinder, to give rules which will meet all the requirements in the simplest possible way, and while some of them may not be new to men of a wide experience, it is safe to say that to countless others in the trade they will prove valuable information.

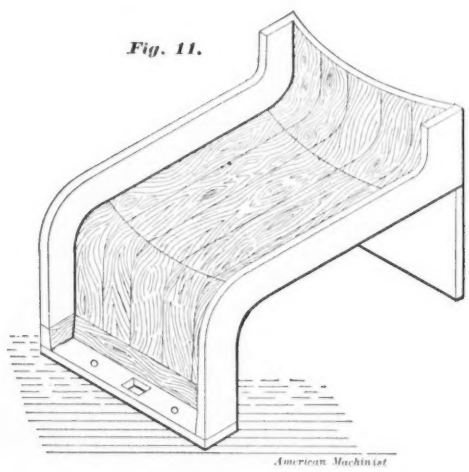
The steam chest as well as the ports and exhaust cores are shown in position in Figs. 1 and 6; a careful examination of the cuts will show how the chest core is made, as well as how best to secure it in its place.

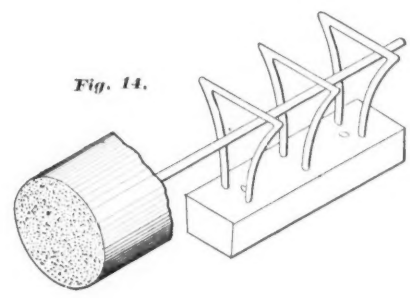
The grate or "core iron" is made with prickers reaching into all the remote parts of the core, care being exercised to leave an open space opposite each of the three cores which are set on it in their respective seats; the sand between these seats is held firmly by the prickers shown; sufficient bearing is left at the ends of each seating on which to rest the ports and exhaust cores, and it will improve the job very much if these bearings are made by setting in iron bearings when the chest core is made. It will be seen, also, that staples are cast into the chest core iron, with which to bolt the same firmly in its seating, as shown at Figs. 1 and 6.

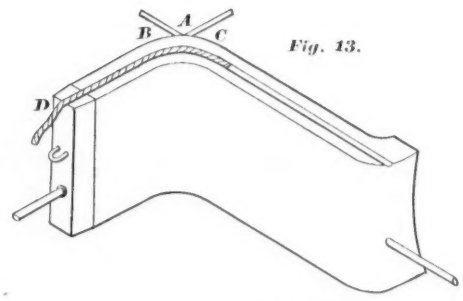
To make port cores have the core box made open, as shown at Fig. 11, with end pieces with which to form that part, and a sweep to form the upper side.

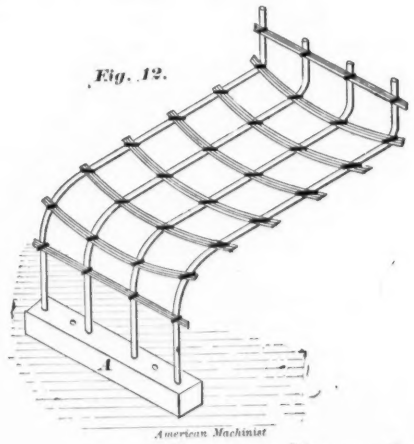
The core irons for all such cores, of any magnitude, are best made as shown at Fig. 12. The manner of making such an iron is to have a pattern made the exact form of the core print, but somewhat smaller, and about three-fourths of the depth of core print; a correct impression of this print is formed in the sand bed, and into it are cast holes for vents, staples for bolting into place, and wrought irons, previously bent to form of core box, of the requisite strength to form a strong core, these irons being further stiffened by securing cross-irons with tie wire, as shown.

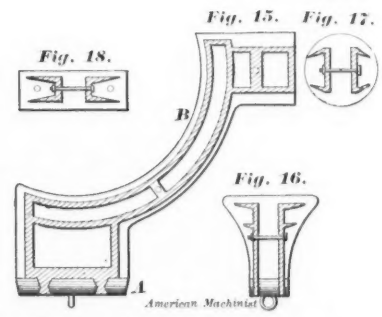
When this core is made, have the vents set after the manner shown at Fig. 13, which figure represents the core as cut off at the top vents to show their correct position, also to explain the manner of connecting the vent after the core has been dried.











CORES FOR MOLDING STEAM CYLINDERS IN DRY SAND.

When the core is made the vent rods pierce the core and meet at *A;* when dry a gutter is cut from *B* to *C* and the rope passed in at *D;* the gutter is then filled up safely and the rope withdrawn, leaving a clean vent hole midway along the whole length of the core.

The above described method of venting is much safer than to attempt the drawing of ropes through the core whilst it is green.

It is needless for me to say that the above is the very best way to make a port core, and when once adopted the system soon finds its way to other cores of different shape, for it must be admitted to be the acme of simplicity.

By referring to Fig. 14 it will be seen that in no sense could the above described method be improved on, even in the exhaust core for this job, and again, at Fig. 15, where the block print is again shown as used for an exhaust core, which, coming out higher up in the mold, requires a more elaborate core iron than the one in question; such core iron being simply two grates cast into the block print *A*, packed between and bolted together. Figs. 16 and 17 show sections at print ends, and Fig. 18 is section at *B*.

Two very important features in work of this class are securing cores in their respective positions and leading off the vents. By the adoption of the block print absolute safety is assured as to the former, and the latter is made equally as safe by using pipes as leaders; it will be readily seen how one thing helps the other in this case; for, on account of the vent hole being in the solid iron, the pipes may be ground in to fit the hole, or tapped, as may be thought best; with such a rig as this there need be no fear of doing damage when the spaces *M M* are being packed with sand after the whole mold has been up-ended, which operation needs to be done to prevent leakage at those parts.

If the principles laid down in the foregoing be strictly followed there will be no difficulty in doing away with the use of paste or any other damp preparation. I would advise molders to avoid all such objectionable helps, as they not only soften the mold and cores, but also create steam, which is something not to be desired if good sound work is looked for; if it is deemed necessary to use a stopping at any critical point, let it be putty, which contains less moisture.

If cast studs and chaplets are used for this class of work, be sure that they are new, or at least perfectly free from rust, and if wrought iron is used it is best to have the stock well ground before they are made, in order that the same shall be free from scale and rust; the mere operation of heating studs before using them is not always sufficient to destroy the accumulations of rust upon them, and if such studs are used and the heat be sufficient to decompose the rust upon them when the mold is poured, the disengaged gases will give trouble either by causing blown places in the casting, or, if enough gas be generated, by blowing up the job.

If studs are to lay long in the mold with any possibility of dampness reaching them it is well to paint them, whilst warm, with a good coat of turpentine mixed with red lead; this will prevent the rust from forming on them.

If a mold or core is damaged by being chipped or broken, do not attempt to repair such places with new material; it is much better practice to pound some of the same material similarly baked, and moisten with very thin clay water; this will adhere more readily than the new, there being less shrinkage in it.

It will be found best, when practicable, to set all port cores back from the body core as much, at least, as will allow of the fin being easily broken through after the cylinder has been bored; this allows any accumulations of fine dirt to pass upwards through the space, leaving it cleaner at that point by just as much as passed through the aperture.

A special meeting of the stockholders of the Vermont & Canada Railroad Company was held last Friday at St. Albans, to take action on the consolidation of the road with the Central Vermont system in the State. The stockholders by unanimous vote accepted and ratified the plan of consolidation which had previously been adopted by the Central Vermont, the Consolidated Railroad Company and the Montpelier & White River Railroad Company. This practically effects the consolidation of the roads named with the Central Vermont Railroad Company.—*Vermont Phoenix.*

The rain makers in this country pride themselves on one part of their performance, viz., that they can produce explosions in the air. To be sure these explosions do not bring rain, but they get the explosions just the same.

Over the river, in Jersey City, a good deal of effort is being made to extend the electric railway system. It is to be the overhead trolley system, and the more of it inaugurated, the worse for the city, in the end.

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Shorter Hours.

It is reported that boiler makers, iron ship builders and machinists in Boston will co operate to obtain, if possible, a nine hour day after May 1st.

We do not know anything of the nature of the efforts to be made for shortening the day in Boston, but we venture to hope that, whatever else may be done, reason and common sense may be used on both sides, and that it will be remembered that very few questions about which men disagree are wholly one-sided. There is a growing belief that the increasing productive powers of labor, resulting from the use of improved machinery, ought in some way to result in the shortening of the hours of labor. That such a result would be desirable we think few will deny who stop to think of the matter, whether they be employers or employed. The difficulty in the matter seems to be to adjust the seemingly conflicting interests in such a way as to make the change practicable. A good deal can, we believe, be accomplished in many cases towards the adjustment of these matters where both the parties in interest approach the question in a reasonable spirit, and make an effort each to comprehend the position of the other. Nothing can be done if the employer on the one hand simply dismisses the whole matter by declaring that the day is now short enough, that the men will simply use the extra leisure demanded in the saloons, and that he is going to run his shop to suit himself, without dictation from any one; or if, on the other hand, the men declare that, simply because they want the hours of work shortened, they should be shortened, that any difficulties which are said to stand in the way are wholly imaginary, or arise from a stubborn disposition to concede nothing until compelled to do so. The first requisite, of course, is to concede that shorter hours of labor—considered without reference to the difficulties in the way of securing them—are desirable. After that, the way is easily cleared for a calm consideration of the question of its practicability from all points of view.

One of the practical considerations in its favor is to be found in the experience of many who have tested the matter and found that an hour's service by a man who works eight hours per day is worth more than an hour's service of the man who works ten hours, other things being equal. This is not universally true, but has been found to be so in some instances. On the other hand, there is to be considered the fact that a considerable part of the cost of maintaining a manufacturing plant goes on all the time, whether it be used in production or not, and that the proportion of this cost is, therefore, increased by shortening the hours of labor. And it should be considered that, in many cases, manufacturing margins are so reduced by the recent development of competition that no considerable increase of cost can be endured by any one manufacturer, unless his competitors are also subjected to the same rule, in which latter case, of course, they can recoup themselves by an increase in the price of goods, which might be better for all concerned. Where margins are large the situation will present less difficulty, and in many lines of work it seems to us that it might be practicable to introduce the system of working two sets of men each eight hours per day. This would give to each workman a short day, and at the same time, by keeping the plant in operation more hours per day, decrease the proportion of many of the fixed charges. Electric lighting has made this possible in some industries in which it would not have been possible formerly. Of course there are many industries in which it is not, and probably never will be practicable to employ two sets of workmen, and there are establishments in which the honest conclusion of the proprietors will be, after candid consideration of the matter, that they can see no practicable way of reducing hours; but it is of prime importance, we think, that both sides should be sure that in the consideration of the matter they are fair-minded and considerate of each other's interests, and when it is made plain that this is the case there will usually be little serious trouble or friction, no matter what the conclusion may be.

An Electrical Invention.

It is reported that, some years ago, Mr. O. S. Kelley, of Springfield, Ohio, purchased an interest in an invention for which a patent application was then pending, and has recently been granted, giving him control of the leading features of the principal systems of electric traction now in use. There is said to have been a contest in the patent office subsequent to the purchase of the interest, during which contest Mr. Kelley bought out the inventor (Green), so that now the former is the sole owner. He is already a very wealthy man, and it is therefore not unlikely that there may be a contest in the courts somewhat similar to that which was not long ago decided in Edison's favor.

The incident again brings prominently forward the fact which we have before commented upon, *i. e.*, that justice is often so expensive that none but the rich can afford to indulge in the luxury. And it seems to the ordinary lay mind that justice, which can only be obtained by the payment of large sums of money, is pretty nearly no justice at all. We do not now refer to money which is said to be often required for the direct purchase of those who have the administration of justice in their hands, and have no reason to suppose that any such money was spent in this case, but we refer to the gigantic system which has been built up by years and centuries of jurisprudence, which none but a trained lawyer can understand anything of—one who has training sufficient to make his services cost far more than most people can afford to pay for them. As we have said before, it ought to be possible for any one to obtain justice by the simple statement of his case to the proper authority, supported by evidence that would be accepted as conclusive in the ordinary affairs of life by people merely using their common sense. This, it seems to us, should be at least the ideal towards which the administration of justice should tend; but, as a matter of fact, the tendency is distinctly the other way. In this case, Mr. Kelley, having bought out Mr. Green, is, of course, entitled to what he can make out of it, but it should have been far easier for Mr. Green to have secured justice for himself, and to have held onto his invention.

Hand Wheels or Crank Handles.

In our issue of last week we published an article, the writer of which evidently believes that there is a good deal of foolishness connected with the handle business, and it must, we think, be admitted that some of his arguments have a great deal of force, especially those that relate to the methods of opening and closing steam valves.

When it comes to handles for machine tools, however, we do not expect that men can ever agree upon what is the best form for all purposes; for, in fact, the best form to adopt in a given case will, we think, depend upon what is to be done. As Mr. Harrison intimates, a hand wheel would be entirely out of place on a vise, but there are plenty of places on machine tools where they seem much better adapted to the place than any other form of handle. It is an advantage in some cases to make use of the stored energy of the hand wheel acting as a fly wheel, and another advantage is that the rim of the wheel always occupies the same place and position with reference to other parts of the machine, and can thus more readily be found by the hand without looking for it.

There is one advantage which the crank handle advocates will have, however, that is, we think, a strong one, and that is the matter of balance. We think few will dispute that all handles of whatever kind used on machine tools should be balanced. There should be no tendency upon the part of any actuating screw to move from the position in which it is placed by the operator until he wishes to move it; for wherever there is such tendency the occasion will arise when the undesired movement may take place. There is very likely to be some trouble from this cause where tools are used on the upper floors of buildings in which there is more or less vibration, and we have known of instances where hand wheels of lathes which were unbalanced had to be balanced on this account. Different men will be influenced by different motives in designing handles for tools, and will thus vary their form; but there should be no difference of opinion as to the desirability of balancing whatever form is adopted. And in this connection it is perhaps well to call attention to the fact that there are more unbalanced crank handles than balanced ones, the ball spoken of by Mr. Harrison as balancing the handle not always performing that function, because in some cases the designer has not properly proportioned it.

Somebody, who signs himself "G. L. C.," has been writing for the New York *Times* a series of articles designed to show how well adapted certain western establishments are to compete with eastern establishments in the building of government vessels, if the restrictions imposed by a treaty with Great Britain regarding the neutrality of the great lakes were only removed. The articles are really quite interesting in some ways, but must not be taken literally at all times. Such little mistakes as the moving of the Niles Tool Works to Alliance, Ohio, the Long & Alstatter Company to Wilmington, Del., and the Putnam Machine Company to Pittsburgh, are not especially blameworthy, considering all the circumstances of the case, perhaps, but when he tells us that at the shops of the Stearns Manufacturing Company, in Erie, there is a new 60" lathe about to be erected, which will "swing forty inches of shafting over the carriage," and that "twenty-five tons weight can be carried over the center of the lathe" (by the traveling crane, perhaps), we begin to have some doubts, and when he further informs us that they have a planer there that will plane all four sides of a piece of work at the same time, we are ready to affirm that there are some things connected with machine shops which have escaped him.

The Central Railroad of New Jersey has put on one of the Vauclain compound engines, and this fact gives the Plainfield correspondent of the *Times* an opportunity to distinguish himself. He says: "The engine has double cylinders, and this adds greatly to its power, for the steam is made to do almost double work." We are further informed that "the New York commuters unite in declaring it to be the best engine they ever rode behind." The ordinary mechanic would have to pursue a course very different from merely riding in a car behind an engine in order to determine its relative excellence, but the New York commuters, most of whom are business men, and know little more of locomotives than locomotives know of them, can determine all about it, we suppose, by looking out of the car windows and observing the landscape as they pass along.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(23) S. H. S., Pittsburgh, Pa., asks: What are the exact proportions of the ingredients for the alloy known under the name of Spence's metal? *A.*—This alloy is prepared by melting together the three sulphides of zinc, iron and lead, with sulphur. We cannot give you the exact proportions, as these are not made known by the manufacturer.

(24) M. B., Allegany, N. Y., writes: Please give me through your columns a receipt for preparing the solution used on paper for blue printing. *A.*—See answer to Question 117, in our issue of March 5, 1891. Your second question we do not repeat, because it is, to say the least, unreasonable.

(25) A. S. M., Bristol, Tenn., writes: Kindly inform me to whom I should apply for a position in the Machinery Hall of the Columbian Exposition. I am a young machinist of about ten years' experience. Kindly give me a few points as to the best way of placing an application. *A.*—Send your application to Mr. L. W. Robinson, Chief of the Machinery Bureau, Chicago, Ill., and state your case clearly and concisely.

(26) M. P., Lowell, Mass., asks: What will be the horse-power of a compound condensing engine—the high-pressure cylinder is 20 inches diameter, and low-pressure cylinder 32 inches diameter; stroke, 10 feet; steam pressure per gauge, 70 pounds? Also what are the areas of both cylinders? *A.*—We should estimate this engine to be 300 horse-power. The area of the 20-inch cylinder is 314.16 square inches; and that of the 32-inch cylinder 804.25 square inches. The ratio is $\frac{804.25}{314.16} = 2.5$.

(27) C. A. D., Brooklyn, N. Y., writes: Please settle a dispute through your Question and Answer columns. I make a claim that a locomotive wheel with facets on its circumference will have less friction with a brake than a true wheel, but it will have more on the rail. A friend disputes me, and says the wheel with facets will have more friction on both the brake and the rail. Which is right? *A*—Practically there will be no difference in the friction of the brake or on the rail in either wheel.

(28) J. N. L., Trenton, N. J., asks: Will you please give me the correct pitch of a $2\frac{3}{8}$" U. S. standard screw; also whether you always take the next size above when not given in the table? *A.*—There is no U. S. standard $2\frac{3}{8}$" screw. A screw which is made to the U. S. standard conforms to it not only in the shape of the thread and number of threads to the inch, but also in diameter, and there is no provision for a $2\frac{3}{8}$" screw; which is the reason it is not given in the tables. If you make such a screw it will not be U. S. Standard, no matter what pitch you make it, and you can therefore choose your own pitch.

(29) J. H. W., Franklin, Pa., writes: Kindly inform me through your columns in regard to the following matter: I wish to replace a simple 10x12-inch engine by a compound engine; what should be the size of cylinders for the latter engine? Will a cylinder 8 inches diameter and 12 inches stroke be right for the high-pressure cylinder? Boiler pressure from 50 to 60 pounds. *A.*—If you had given us the power developed by the simple engine, or the point of cut-off, we would be in a better position to answer you correctly. As it is, we can only give you a rough approximation. The high-pressure cylinder we should make 9 inches diameter, and the low-pressure 13 inches diameter, both 12 inches stroke. It is very doubtful if you will gain any advantage by compounding with such a low steam pressure.

(30) P. O., Versailles, Ky., writes: I inclose a full-size drawing of valve and valve seat of a 14x24 inch throttling engine; speed, 95 revolutions per minute; boiler pressure, 65 pounds; length of ports, 10 inches; travel of valve, $3\frac{1}{2}$ inches. We would like to know if the opening in the valve marked *a* is an advantage in saving steam. It seems to me that the expansion is allowed to communicate with the compression toward the end of the stroke. *A.*—Your valve resembles an Allen valve, but the position of the supplementary ports will not allow it to do the duty of an Allen valve. We do not see any advantage to be derived from your design of valve. 2. The engine is larger than necessary. What amount of lap will be necessary to get the best results? *A.*—It is difficult to advise you, since we do not know how much too large the engine is. With the present lap your engine cuts off steam at about $\frac{3}{4}$ stroke. We should not hesitate to increase the lap to $1\frac{1}{16}$ inch, so as to cut off at $\frac{5}{8}$ of the stroke.

(31) C. C. J., Tacoma, Wash., writes: Please give me a receipt for a cement used in setting thick glass lights into cast-iron sidewalk frames. I have $\frac{1}{8}$ of an inch all around the glass to fill in. *A*—A mixture of tar and sulphur of the consistency of putty is often used for the purpose. Another cement is made of soluble glass, thoroughly stirred and mixed with fine chalk, and the coloring matter well incorporated. As soluble glass can be kept on hand in liquid form, and the chalk and coloring matters are permanent and cheap, the colored cements can be readily prepared when wanted, and the material can be kept in stock, ready for use, at but little expense. If a black color is required, use for the coloring matter well sifted sulphide of antimony. Another kind of cement is made of litharge and red lead, equal parts, mixed thoroughly and made into a paste with concentrated glycerine to the consistency of soft putty. This cement takes some little time to dry, but turns almost as hard as stone, and is fireproof and water-proof.

(32) C. J. D., Mount Vernon, Ohio, writes: Please inform me through your columns how to prepare blue print paper in a continuous roll. We have been in the habit of preparing a little at a time, and would save much time by preparing a whole roll at once, but I do not know how. *A.*—Partition off a closet, and in it arrange a number of horizontal bars for holding the paper during the time it is drying. The roll of paper should be placed opposite to the closet and supported horizontally on pivots on which the roll can turn as the paper is unwound. Leave sufficient space between the roll and the closet for applying the blue print mixture, which, as the paper is unwound, is applied in the usual way, and then the paper is passed into the closet through a slot cut in the partition and allowed to dry on the bars put up for the purpose. Paper in very long sheets should be prepared in the evenings, because it sometimes requires quite a little time to arrange the paper in the closet, leaving a part exposed, and should this occur at daylight, the sensitiveness of the exposed part may be injured.

(33) O. N. T., Philadelphia, Pa., writes: Please make the necessary corrections through your Question and Answer columns of the inclosed dimensions of a steam engine. Speed of engine, 175 revolutions per minute; boiler pressure, 60 pounds; cylinder, 8 inches diameter; stroke, 10 inches; steam ports, $\frac{1}{4}$x6 inches; exhaust port, $1\frac{1}{16}$ inch wide; thickness of metal between ports, $\frac{3}{4}$ inch; thickness of cylinder, $\frac{7}{8}$ inch, allowance being made for reboring twice; piston rod, $1\frac{1}{4}$ inch diameter; connecting rod, $1\frac{1}{2}$ inch at ends, 2 inches in the center, and 33 inches long; crank-pin, $1\frac{1}{8}$x$2\frac{1}{2}$. What should be the inside and outside lap to cut off at $\frac{3}{4}$ stroke? *A.*—The thickness of metal of cylinder and that between ports can be reduced $\frac{1}{8}$ of an inch; the diameter at the center of connecting rod can be reduced $\frac{1}{8}$ of an inch. If the crank-pin overhangs, the dimensions are correct; if it is placed between two cranks, its diameter should be equal to that of the shaft. Your other dimensions are correct. To cut off at $\frac{3}{4}$ of the stroke, the outside lap should be equal to the width of steam port, the travel of the valve being equal to twice the sum of the lap and width of steam port. You may make the inside lap equal to $\frac{1}{32}$ of an inch, so as to be certain that both steam ports are covered when the valve stands in a central position.

(34) W. B. K., South Bend, Ind., writes: I am an apprentice in a machine shop here; I have been working at the trade one and one-half years. I have made up my mind to try and be a mechanical engineer, and wish to begin to study and work with that aim in view. I go to night school and am studying arithmetic; will take up algebra soon, and will finish geometry before my time at school is up. Must I go to college? Being an apprentice, and self-supporting, my means are very scarce. I wish you would please inform me of the best way to start out. I would like to study some books. You have now my situation and desire, and I am willing to try any method you may advise. *A.*—Although it is not absolutely necessary to go to college, it is best to do so; your progress will be more rapid and more satisfactory. We should therefore advise you to work out your apprenticeship and learn as much of the practical part of the business as you possibly can, and save enough of your wages to enable you to go to college. In the meantime continue your studies in the evenings, and also send to several colleges for their circulars, so that you will know what studies to pursue to enable you to pass the necessary examination for admission. If your means will prevent you from going to college, do not be discouraged, but follow the course indicated in our issue of February 19, 1891. With perseverance and hard work you will finally succeed.

(35) W. G. H., Hyde Park, Mass., writes: Please give me a formula to determine the dimensions of the crank and crosshead pin for a 10x15 inch engine to run at a speed of 250 revolutions per minute. Should the pins be made larger for higher speeds? *A.*—The dimensions for a crank-pin found by rules given by different authorities vary greatly, and perhaps there is no other part of an engine for which rules give such perplexing results. The crank-pin should be designed to work without heating under unfavorable circumstances. Heating depends somewhat on the material in the boxes, which were made of brass until recent years; now they are frequently lined with white metal. The shaft may be out of line, and the crank-pin may not be as free from dust as is desirable, and yet it is expected to work cool. Manufacturers of stationary steam engines generally make the diameter of an overhung crank-pin equal to $\frac{1}{4}$ of the diameter of the cylinder, and the length about 25 per cent. greater than its diameter. These proportions are usually adopted for all speeds. The size of crosshead pin is generally limited by the design of engine. In many engines the crosshead pin is too small, and is a source of trouble and annoyance. The diameter of this pin should be at least $\frac{1}{4}$ of the diameter of the cylinder, and its length about 25 per cent greater than its diameter. According to these proportions the size of the crank pin for your engine will be $2\frac{1}{4}$ inches diameter and $3\frac{1}{8}$ inches long. The size of crosshead pin will be, in the nearest, $\frac{1}{8}$ of an inch, $1\frac{3}{4}$ inches diameter, and $2\frac{1}{4}$ inches long. When a crank-pin is placed between two cranks its diameter should be equal to the diameter of the crankshaft. In all cases it is best not to allow the pressure on the crank-pin in stationary engines to exceed 800 pounds per square inch of projected area. By projected area is meant the product of the length of the pin into its diameter.

(36) H. M. C., Detroit, Mich., writes: You will confer a great favor by giving through your columns an exact formula to obtain the length of an open belt, also of a crossed belt. *A.*—See our issues of July 14 and 21, 1888. 2. How much lap should be allowed for cementing the belt? *A.*—From 4 to 6 inches. 3. Would it not be improper to cement a belt before it is placed around its pulleys and held firm with clamps for that purpose? *A.*—We prefer to place the belt on the pulleys, give it the proper amount of tension by means of suitable clamps, and then apply the cement, the clamps remaining in position until the cement becomes dry. 4. Does not the position of the line, whether vertical, horizontal, or at an angle of 45 degrees, have some effect on the belt to the extent of its being tight? *A.*—Yes. Vertical belts should be avoided as much as possible, as in such cases the belt must be kept very tight to do the work. It is desirable that the angle of the belt with the floor should not exceed 45 degrees. 5. Should there not be a certain amount of sag? *A.*—It is difficult to give an exact rule for the sag. A general rule may be stated thus: For narrow belts running over small pulleys, the shafts being 15 feet apart, a sag of $1\frac{1}{2}$ to 2 inches is a good average. For larger belts, working on larger pulleys, the shafts being 20 to 25 feet apart, a sag of $2\frac{1}{2}$ to 4 inches does well. For main belts working on very large pulleys, with 25 feet to 30 feet between shafts, a sag of 4 to 5 inches may be allowed. 6. Will a tight belt give more even speed and power than one in which there is sag? *A.*—With a very tight belt more power can be transmitted, but often it will be at the expense of broken pulleys, hot boxes, increase of friction, which means an increase of coal bills. A sag is generally an indication that the belt has no more strain imposed upon it than is necessary simply to transmit power; and the speed will be as steady as can be obtained with a tight belt.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's new 1892 Gear Book. See page 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Self-setting Planes. G. T. Co., Vineland, N. J.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

$13.00 I Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

S. A. Smith, 23 South Canal Street, Chicago, Ill. agent for Holbrook's Raw Hide Blanks for Gears.

Save small iron from foundry refuse. It pays Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

"Roper's Hand-books for Engineers and Firemen." Descriptive Catalogue mailed free to any address. Edw. Meeks, Pub., 1012 Walnut St., Phila., Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

For Sale—One second-hand Punch and Shear combined; one second-hand Wiley & Russell Bolt Cutter. W. P. Davis, Rochester, N. Y.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

Planer Chucks and 13" Upright Drills. For cuts and price address G. W. Jordan, No. 4 Wayne Street, Worcester, Mass.

25" } "Only Drill Press built on
32" } 'Ko-rekt' principles,
37" } Even if they come from Jersey."
42" } Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St., N. Y.

"Hawkins' Maxims and Instructions for the Boiler-room." 10 Parts, 25 cents each. Catalogue free. Theo. Audel & Co., Pubs., 91 Liberty St., N.Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., N. Y.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Mineral Production in 1891.

The Engineering and Mining Journal, in its issue of January 2, publishes complete statistics of mineral production in this country for 1891. A very large mass of information has been gathered together, and that it should be published by private enterprise, and so soon after the close of the year, is very creditable. The value of all minerals produced in the United States in 1890 was, in the place of their production, $650,000,000. The values for 1891 are lower, though the quantities were greater, this being caused by the fact that prices were materially lower. The output of gold for 1891 was approximately 1,620,000 ounces, valued at $33,250,000. Of silver there were produced about 58,000,000 ounces, the coining value of which would be $74,820,000. Of anthracite coal, 42,839,779 long tons were produced, and of bituminous coal 98,000,000 tons. Of pig iron there were produced 8,976,000 net tons—a falling off from the previous year of 1,331,028 tons.

This number of our contemporary will prove particularly valuable during the year as a reference in regard to the production of minerals.

The Eight Hours' Day in Sunderland.

In our last impression we told our readers how Mr. Allan and Mr. Short, of Sunderland, had made proposals for an eight hours' day to their men, and described in detail the nature of the scheme. On Saturday there was a crowded meeting of the Amalgamated Engineers held in the Central Coffee Tavern, Sunderland, and, after some discussion, a resolution recommending "that the whole of Mr. Allan's proposals be accepted" was carried unanimously. The eight hours' day will come into force at Messrs. Allan and Co.'s establishment on January 1st. It will be remembered that one of the essential features in the scheme was that there should be but one break in the day for meals, the break representing in all cases a dead loss to an employer, quite apart from the men's absence. Some of those present at the meeting were, however, indisposed to accept a day with but one break. They were overruled, however; but the ominous argument was held that as soon as more employers had adopted the eight hours' day, details could be adjusted. So far, the experiment is a success. It remains now to be seen how it will work in practice. The whole episode is a strong argument against those who wish for an act of Parliament to fix the length of the working day. The gravest consideration

is that if eight hours are demanded this year a seven hours' day will be wanted next. Already we have heard this talked of. There is no special magic or virtue about an eight hours' day that should make it more lasting as an institution than a day of any other number of hours. There is, however, a power over which neither masters nor men have any control, namely, the state of trade, which will settle in the long run how many hours must be worked in any branch of industry.—*The Engineer* (London).

A correspondent would like some of our readers to give him a plan whereby he can make a foundation in sandy soil that will prevent a drop-hammer from shaking the buildings in the immediate neighborhood. The anvil weighs six tons, and the hammer one ton. The hammer is used on thin work, the top and bottom dies often coming together. The hammer strikes a heavy blow.

MANUFACTURES.

Ten citizens of Boise City, Ill., are understood to have taken $500 worth of stock each in the proposed foundry and machine company at that place.

The Parker & Knight Company has been incorporated at Baltimore, Md., for the manufacture of machine tools, etc. The capital stock is $25,000.

E. Brady & Sons, of Baltimore, Md., have contract for rebuilding the Baltimore & Ohio Railroad Co.'s electric light and power plant reported destroyed last week.

D. H. McMullen, G. M. Armour and Thomas Winsor have incorporated the Ballard Electric Company, with a capital stock of $25,000, at Washington, D. C.

At Milford, Mass., the new Coupling and Nozzle Company is soon to commence operations in the Johnson & Ross shop. Five hundred hands will be employed.

The Dallas (Tex.) Ice Factory and Cold Storage Co. is reported as putting in new machinery to increase the capacity of its ice factory and cold storage plant.

The stockholders of the Oliver Iron and Steel Company, of Pittsburgh, Pa., have voted to increase the capital stock of the company from $1,600,000 to $2,000,000.

W. H. Nicholson & Co., Wilkes-Barre, Pa., have issued a circular relating to their expanding lathe mandrels, compression shaft couplings, and other specialties.

The Kittselman Wire Fence Company, of St. Thomas, Ont., is being organized, with a capital stock of $10,000, for the manufacture of wire fence goods, etc.

The city council, Mobile, Ala., will meet on January 5th to decide the question of purchasing electric light plant. For information address J. C. Rich, mayor.

Parker & Waters, of the Saline Iron Works, Warren, Ark., write us that they expect to put up a small ice factory and water-works there this coming spring.

Projectors of a new cotton-mill at Hammond, Ind., have purchased 140 acres of land for $248,000, and will erect the buildings. Houses for the operatives will be built.

A. W. Ward is organizing a company at Charleston, W. Va., to control a self-oiling car wheel flange and self-locking nut, for which he has recently received patents.

Cranston & Jones, 57 Park street, New York, are now building a friction pulley of their own patent, 90"x17", for the Watertown Electric Light Company, Watertown, N. Y.

Mr. A. Ellison has completed a contract to build a station at Edgar, Ont., for the Michigan Central. He is building a new ice house, 40x200 feet, for the company at Windsor, Ont.

The Standard Iron Works, Wheeling, W. Va., will, it is stated, put in three or four new sheet-mills, erect several puddling furnaces and otherwise improve its iron works.

When a person cannot find Dixon's American Graphite pencils in the hands of dealers, he is invited by the Jos. Dixon Crucible Co., Jersey City, N. J., to send 16 cents in stamps for samples.

It is stated that Mason & Harrison, of Waco, Tex., are investigating with a view of establishing a branch factory in Chattanooga, Tenn., for the manufacture of their cotton picking machines.

The Louisville, Evansville & St Louis Consolidated is having plans made for a new and substantial freight and passenger station on Broadway at the approach of the viaduct to St. Louis.

The Missouri Iron Roofing and Corrugating Company, of St. Louis, Mo., are making additions and improvements to their present plant. The present works will be rebuilt, and an addition 140x30 feet erected.

The Commonwealth Cotton Factory, Durham, N. C., is to be pushed to completion, and the knitting and cotton machinery will be purchased as soon as possible and set up. T. H. B. Haase is interested.

John H. Parker, F. E. Knight, Chauncey J. Weatherby and others have incorporated the Parker & Knight Co., at Baltimore, Md., for the manufacture of machine tools, etc. The capital stock is $25,000.

Mr. Edwin Beers, manager of the Safety Barb Wire Company, of Toronto, Canada, has been in the city the past week looking over the ground with the view of establishing a barb wire factory in Denver, Colorado.

The American Manufacturing Company, St. Paul, Minn., has changed its name to the American Hoist and Derrick Company. The company manufactures elevators of all kinds, and hoisting machinery in great variety.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded the contract for building a 20-stall roundhouse at Bellefontaine, O., which will succeed Galion as a divisional terminal next spring. The roundhouse will cost $30,000.

J. E. Snyder (Upright Drills), Worcester, Mass., writes us: With regard to business the year ending December 31st, 1891, will say trade was not up to 1890, but was quite satisfactory; prospects are fair for a good trade the present year.

The Jos. Dixon Crucible Company, Jersey City, N. J., has issued a circular describing and illustrating the various uses to which graphite is put. It is a catalogue that will be of interest alike to engineers, mechanics and manufacturers.

The Leonard Manufacturing Company has been incorporated, at Hartford, Conn., by the Secretary of State, to manufacture corn harvesters, and other agricultural and mechanical implements and tools at New Hartford. The capital is $30,000.

The assignees of the Blandon Iron and Steel Company, of Blandon, Pa., are endeavoring to organize a new company, with the creditors as stockholders. It is quite probable that a settlement will be effected, and the works started up again.

The Alantic Coast Line is asking for bids for the construction of a train shed of iron or steel at Goldsboro, N. C. The structure is to be 300 feet long, with a roof span of 50 feet x 21 feet, clear above the ground, and an overhang on one side of 10 feet.

Wilberforce Daniel, J. D. Hahn, W. E. Keener and Robert Schley have incorporated the Georgia Lime and Fertilizer Company at Augusta, Ga., for the purpose of pulverizing carbonate and sulphate of lime, manufacturing fertilizers, etc.; capital stock, $12,000.

The Phœnix Foundry and Machine Works, situated at Pinkey street and the Belt Line in Omaha, is about to increase its plant by the addition of works for making car wheels, axles, etc. For the present, the capacity of the works will not exceed 20 car wheels a day.

The signal invented by S. H. Harrington, formerly chief draftsman of the Pan Handle, and later mechanical engineer of the Big Four, is to be manufactured by the Barney & Smith Co., of Dayton, under arrangement with the Harrington Signal Company, of Indianapolis.

The Kent Iron Company, of New Milford, Conn., will suspend operations for an indefinite period next week. The works have been run continuously for nearly fifty years, but of late have made no money, on account of the severe competition from more favorably located works.

B. M. Jones & Co., 11-13 Oliver street, Boston, Mass., and 148 Liberty street, New York, issue a little circular containing an extract from a paper read before the New England Railroad Club, in regard to the use of Mushet steel. It will doubtless be interesting reading for mechanics and manufacturers.

George V. Cresson, Philadelphia Shafting Works, Eighteenth street and Allegheny street, issue a circular of power and transmitting machinery and its appurtenances, in which a great many excellent transmitting devices are illustrated and described. The catalogue is one that will interest mechanics and manufacturers.

The Inland Construction and Equipment Company has been formed at Spokane, Washington, with capital stock of $200,000. The company proposes to build and operate railways, steamboats and telegraph lines. Those interested are W. H. Kennedy, L. S. Howlett, B. H. Bennett, C. F. Clough and F. E. Goodall.

Howard White, 44 North Fourth street, Philadelphia, Pa., issues a circular illustrating and describing his metallic fillet for pattern makers. It appears to us to be an excellent thing, and pattern makers will make no mistake in, at least, studying its merits. The circular gives the opinions of a good many users as to its merits.

The Detroit Dry Dock Company has contracted with the Berlin Iron Bridge Company, East Berlin, Conn., for a new fire-proof machine shop. The shop is to be 66x201 feet, with two electric cranes covering the space. The height of the building (50 feet in the clear) will admit of galleries, which will be 28 feet wide. The company will also build a new boiler shop.

Park, Brother & Co., Limited, proprietors of the Black Diamond Steel Works at Pittsburgh, will increase their present capacity by the erection of two new mills. A 10-inch billet-mill, in connection with a 19-inch tire and hoop mill, will be erected, and will be operated by a 30x48" engine. The contract for the erection of the mills and engine has been secured by Mackintosh, Hemphill & Co., Limited, of Pittsburgh.

The Caldwell Mfg. Company, Rochester, N. Y., manufacturers of the well-known Caldwell sash balance, report a very large increase in trade for 1891. The company have perfected new labor-saving machinery, and are making arrangements to double their plant the coming year, to meet the widely growing demand in all branches of their trade for house windows, car windows, show-cases and ship windows.

The Mekarsky American Compressed Air Motor Company, recently incorporated at Albany, N. Y., is to manufacture and sell compressed air motors, air compressors, and all other machinery necessary therewith. Location of its business will be at North Tarrytown, N. Y. The company has a capital of $1,000,000, which is to consist of cash, patent rights, and other property. The directors are Edward C. Nichols, of Dunkirk; George E. Whipple, of Westfield, Mass.; C. P. Laurenson and E. F. Abel, of Baltimore; and Addison C. Randall, J. F. Lewis and C. B. Johnson, of New York City.

David S. Creswell has just opened his foundry at Nicetown Station, Philadelphia, making a successful pour-off of his first heat, amid the presence of many invited guests from Philadelphia and the vicinity. The capacity of his new foundry will be 35,000 pounds per day. The building is large, airy, and equipped with a swinging jib crane of 50,000 pounds capacity, Root blower, independent blower engine, Wetherill cupola, and all modern improvements for handling rapidly and economically general foundry work. During the time of melting, the invited guests partook of a handsome repast.

New York City Bolt & Nut Company (Limited), 33-35 Desbrosses street, New York, write us: We wish to state that our business for the year 1891 has been very satisfactory; in fact, the magnitude of our orders has compelled us to double our plant within the last six months. The demand for special shaped bolts was far beyond our expectations, and looking back for the past twelve months we simply ask for a repetition of such numerous orders as in the past. The outlook for the present year seems to be decidedly good. Thanking you and all our patrons for past favors, we hope to be able to tender as cheerful a report at the close of this year.

Jones & Mack (Mechanical Engineers), Cincinnati, Ohio, write us: During the past year our business has been exceptionally good in both the engineering and manufacturing departments. Our books show that the sales of our drawing table have doubled about every three months during the year, which convinces us that draftsmen in general are getting tired of the old-time trestle and other makeshifts, and that they appreciate a table that is designed with an eye to their convenience and comfort. The increased demand has forced us to put in special tools for their manufacture, and as we don't want the earth, our price-list for 1892 shows a corresponding reduction in the price. We think the outlook for 1892 is good.

J. Wyke & Company (Machinists' Tools), East Boston, Mass., write us: Our business has been very good; it has exceeded that of 1890. The demand for our tools is steadily increasing, both in the United States and in foreign countries. We have lately put on the market a new tool for setting shafting on the drilling, milling or planing machine when about to have keyseats, slots, splines, etc., cut in them; also for setting the tools required for doing the work. By the use of this tool the work can be done rapidly, correctly and mechanically. This tool has been on the market only about six months, and it is now in use in many of the principal engineers', machinists' and railroad shops in the United States, Europe and Australia. We have an illustrated circular of this tool which any one can have for the asking. We have reason to believe that the year 1892 will prove a good year for us.

The Lane & Bodley Company (Corliss and other types of Engines, Boilers, Saw-mills, Gearing, Shafting, Pulleys and Hangers, and General Machinery, etc.,) Cincinnati, Ohio, write us: We can report a fair business during the past year; a large portion of the year we were engaged in reconstructing our shop, building a new foundry, and increasing our facilities for doing heavy work; this necessarily restricted our production. We have now concentrated our works on one side of the street, with receiving and shipping switches to the connection track, having connection to all railroads; the shipping switch enters across our foundry and engine erecting shop, so all loading is done under cover. The new shop made necessary the abandonment of the department devoted to boilers, for the present at least. We confidently expect a larger business and a better range of prices next year. Our pneumatic traveling cranes have proved very successful.

George D. Walcott & Son (Machine Tools), Jackson, Mich., write us: We have had all that we could do throughout the year just passed; at times unable to fill our orders as promptly as we could wish, at no time accumulating stock, nor can we now. We keep a large number of tools in process, including most of our line. They are demanded as fast as we are able to complete them. We aim to make first-class tools only, and, as cost is greater, our prices are higher than some. Our business is gradually improving each year as our tools become known. Within the last fifteen months we have doubled our floor room, and added quite a number of tools, the largest being 36"x16' engine lathe and 34 inch shaper. We have in process for our own use several tools, among them a lathe for cutting longer bevel screws than we are able to cut now—25 feet between centers. We expect to add about thirty per cent. to our present room as soon as we can build in the spring. Prospects look well for the year before us, and we look for something of an increase in demand, as we have had in years gone by.

Machinists' Supplies and Iron.

NEW YORK, January 16, 1892.

Iron—American Pig—There is still no sign of improvement, and trade is very quiet.

We quote Standard Northern brands, No. 1 Foundry, at $16 to $17; No. 2, $15 to $16.50; Grey Forge, $13.75 to $14.50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.50 to $16 for No. 2; $14.25 to $14.50 for No. 3.

Scotch Pig—Coltness is quoted at $22; Eglington, $20.25.

Antimony—Spot supplies are getting somewhat short, and there is an improved demand.

We quote Cookson's, 16c. to 16½c.; Hallett's, 12c. to 12¼c.; L. X., 15c. to 15¼c.

Copper—The market here is quiet and steady. Spot Lake is freely offered at 11c.; Casting Copper is firm at 10⅝c. to 10¾c.

Lead—Prices are weaker, and the demand light. Sales have been made at 4.20c., and buyers are offering 4.15c.

Lard Oil—Prime City is quoted at 54c. to 55c.; Western at 53c. to 54c.

Spelter—There has been no new business of importance, and the market is steady at 4.70c. to 4.75c.

Tin—The market is very quiet, and prices are nominal at 19.85c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situation as sup't or foreman pattern maker, by an A1 practical mechanic. Pattern, AM. MACHINIST.

A young man, 17, wants to learn pattern making; 6 months' exp.; city or country. C. G., AM. MACH.

Constructing eng'r desires steam plant work or supt's position; salary, $200 m'thly. M. E., AM. MACH.

Young assistant mechanical draftsman desires change. Address Box 35, AMERICAN MACHINIST.

Foreman of small brass foundry desires change of position. A1 refs. Brass Molder, AM. MACH.

Wanted—Foundry foreman; one who is familiar with machine and car wheel work pref'd. Address, giving refs. and exp., Foundry, AM. MACHINIST.

Wanted—A good designer accustomed to strain calculations. Also a good detail draftsman. Address, with refs. and particulars, Ajax, AM. MACH.

Wanted—1st-class machinist, one thor'ly acquainted with the Niles upright boring and turning mill. James Hunter Machine Co., North Adams, Mass.

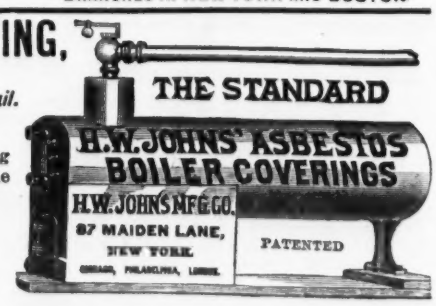
Bradley Hammers

REPUTATION.
Men test everything in this world by what it produces.
2000 IN USE
BRADLEY & COMPANY,
SYRACUSE, N. Y.
BRANCHES IN NEW YORK AND BOSTON

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



Wanted—First-class tool dresser; steady employment at $3.00 per day; give age and reference. "Milwaukee," care AMERICAN MACHINIST.

Machinist, 17 years' exp., wants situation to erect heavy machinery, or as foreman for machine shop. Address W. G. A., AM. MACHINIST.

Graduate of technical school, with some experience as draftsman, desires position; South preferred. Address Box 33, AMERICAN MACHINIST.

Position as foreman or tool maker by first-class machinist; can do drafting. Address Box 32, AM. MACHINIST.

If you want a first-class foreman, energetic and a pusher, on engine, machine tools, and general work, let me hear from or meet you. L. J., AMERICAN MACHINIST.

Wanted—A position as foundry foreman; having 20 years' experience on all kinds of light and heavy work, can furnish first-class recommend. Address Box 29, AM. MACHINIST

Wanted—A skilled young pattern maker, to work for board and tuition in a university; state age, experience, and past wages; draftsman wanted on same terms. Address Box 30, AMERICAN MACHINIST.

Wanted—Position as supt. or foreman, by a practical engineer and machinist of wide exp. on machine tools, steam engs., and electrical mach'y; well up in modern practice and the economical manage't of men; A1 references. Expert, care AM. MACHINIST.

Wanted—A first-class workman that is experienced in taking charge of a shop on nice light machine work. None but a first-class man need apply. Address A. K. Z., 3032 5th Avenue, South Minneapolis, Minn.

Wanted—Young man to take charge of about 20 lathe hands, who has had experience as gang boss on piece-work system; also one to take charge of about 20 men on vise work. Address Manufacturer, care AMERICAN MACHINIST.

Mech. eng'r who is not a tech. graduate, nor does he know everything under the sun, but who can take charge of power installation from drafting-room to completion, desires such work; speaks German fluently. Am. Society, AM. MACHINIST.

Wanted—An engineer to go to Tacoma, Wash., competent to take charge of the erection of Corliss engines and boilers; preference will be given to a single man; applicants will please furnish refs., state exp., age, and wages expected; Co. will pay traveling expenses and board. Tacoma, care AM. MACHINIST.

Wanted—A man to take charge of tool-room, which is thoroughly equipped with modern first-class tools, and working about 15 men; must be well posted in manufacture of milling cutters, jigs, templates and special tools; location, western Pennsylvania. Address Box 34, AMERICAN MACHINIST.

+ MISCELLANEOUS WANTS +

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

I wish to contract with parties to furnish them fine composition castings. B., AM. MACH.

Wanted—Small second-hand Ice Machine. Parker & Waters, Warren, Ark.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

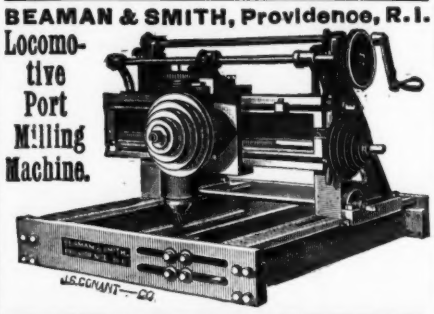
Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

BEAMAN & SMITH, Providence, R. I.

Locomotive Port Milling Machine.



STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

THE GAS ENGINE.

History and Practical Working. By **DUGALD CLERK.** With over 100 engravings. 12mo., cloth, $2.00.

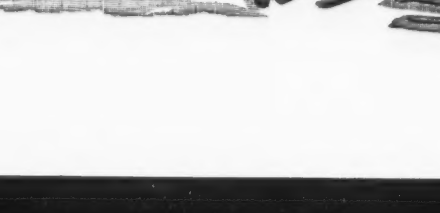
JNO. WILEY & SONS,
53 East 10th St., New York.

CHAS. A. STRELINGER & CO.,
Tools, Supplies and Machinery,
DETROIT, MICH.

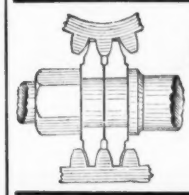
Machine Tool Business For Sale.

The advertiser, desiring to give his personal attention to other business, wishes to dispose of his Machine Tool Manufacturing Business, which is well established and located in an important center for that business. Stock, Machinery and Business are worth $30,000, with contracts and agencies insuring a prosperous business. Address, MACHINE TOOLS, care of AMERICAN MACHINIST.

AGENTS WANTED EVERYWHERE
For the newest, most complete, and cheapest
BELT CONNECTION.
Address, RUDOLF MOSSE, Leipzig, Germany.



Paragon Drawing Instruments, Extra and Best Quality, German Drawing Instruments, Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile and Cross-section Papers. Catalogue to professional people on application.



CLOUCH'S DUPLEX CUTTERS.

Reduction in prices to clear out my stock on hand. Now is the time to buy, as they will soon be gone. All sizes from 3 to 48 Pitch. Address

R. M. CLOUGH,
TOLLAND, CONN.

FOR SALE

An old-established device for removing flues from boilers. Is being used in leading shops. A fortune in it. Can be purchased reasonably. Address

VANCE TUBE CUTTER CO.,
GENEVA, N. Y.

POPULAR AND INSTRUCTIVE BOOKS
FOR ENGINEERS AND FIREMEN,
By **STEPHEN ROPER, Engineer.**

Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them.

Descriptive Catalogue Mailed Free.

EDWARD MEEKS, Publisher,
No. 1012 Walnut St., PHILADELPHIA, PA.

FOR SALE OR LICENSE

The United States Patent of a mechanical invention, returning good profits, in England (books produced). List prices from £25 up to very large amounts, and principally large castings, with very little machine work below. Address S.,
The International News Co.,
Breams Buildings, Chancery Lane,
London, England.

SOFT GRAY IRON CASTINGS.

From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

ONTARIO IRON WORKS
CANANDAIGUA, N. Y.

New and Second-hand Machinery
AND MACHINISTS' SUPPLIES.

	Listed at
2 Backgeared Screw Cutting Reed Lathes, 8 ft. 4 in. long, 18 in. swing	$250 00
3 Backgeared Screw Cutting Reed Lathes, 6 ft. 2 in. long, 16 in. swing	200 00
11 Backgeared Screw Cutting Reed Lathes, 6 ft. 4 in. long, 14 in. swing	180 00
Above Lathes, latest improved cross-feed.	
1 Universal Milling Machine, Brown & Sharpe, with attachments, cutters and spindles	400 00
1 Wood Turning Lathe with slide rest, 26 in. swing, 10 ft. bed	190 00
1 Pratt & Whitney Monitor Screw Machine	250 00
1 Lathe, 6 ft. long, 12 in. swing, Prentice	185 00
1 No. 2—4 Spindle Drill Press Garvin	140 00
1 No. 4—4 " " " "	230 00
1 Speed Lathe, 4 ft. long, 13 in. swing	75 00
1 Lathe, " " " "	75 00
1 Lathe, 3 ft. 6 in. long, 10 in. swing, Reed	65 00
1 Shaping Machine, 16 in., Prentice	250 00
1 Small Monitor Lathe, 3 ft. 6 in. long	160 00
1 Power Punch Press, No. 94, E. W. Bliss	200 00
1 Shaping Machine, 24 in. stroke, Hendey	35 00
1 Small Grinding Machine	130 00
1 2 Spindle Drill Press, Sigourney & Co.	130 00
1 Power Press No. 2, Styles & Parker	150 00
1 Small Lathe, 4 ft. long, 9 in. swing, Young & Co., Geared for Screw Cutting	60 00
1 Small Emery Grinder	20 00
1 No. 1 Diamond Emery Wheel	18 00
1 No. 3 Emery Grinder	90 00
1 Poppin Grindstone, No. 0	6 00
1 Sturtevant Forge	20 00
3 Single Spindle Drill Presses, Reed	125 00

SECOND-HAND BELTING GOOD AS NEW.

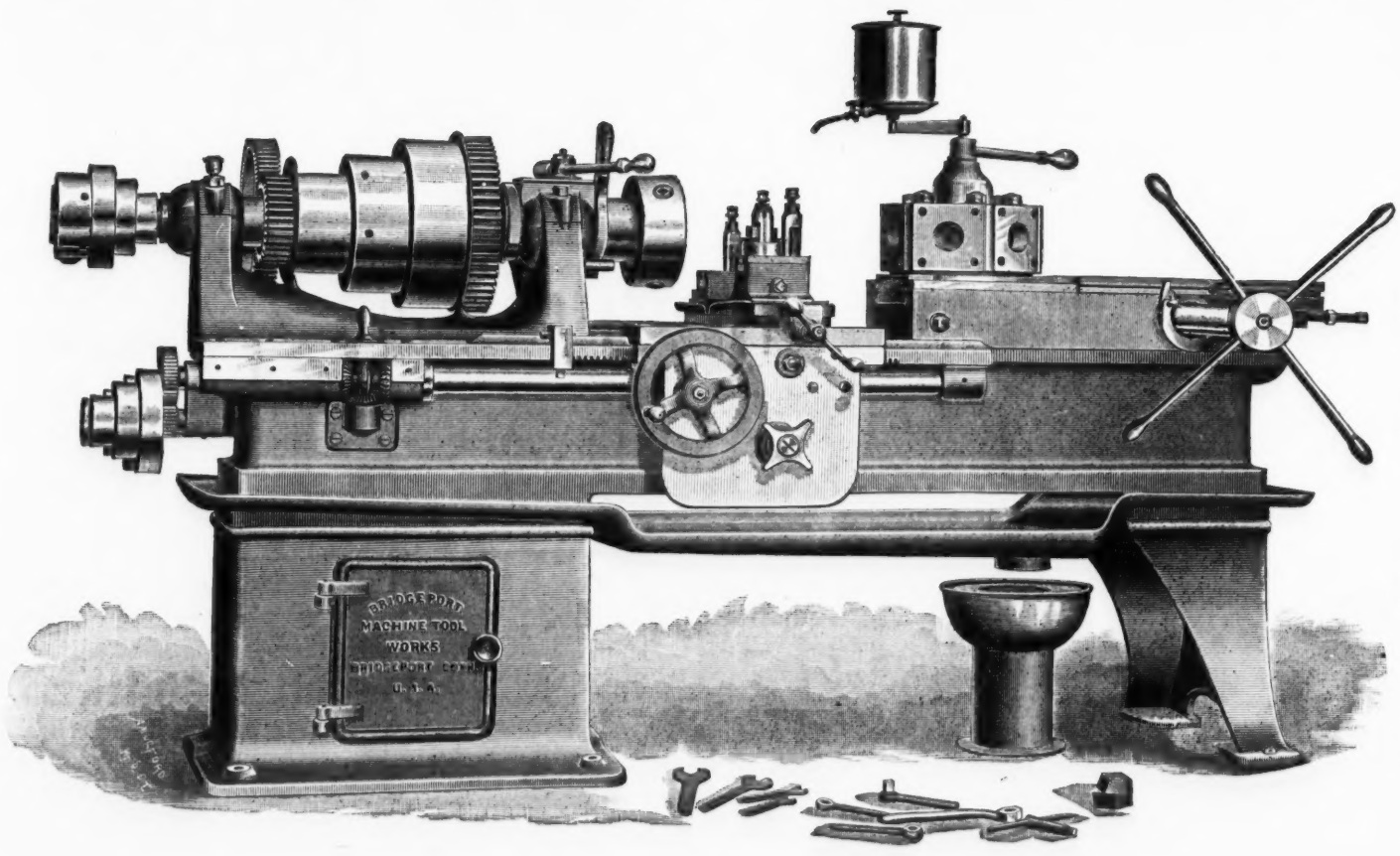
Also an assortment of Iron Split Pulleys, Lathe and Drill Chucks of all sizes, and other small tools, such as Drills, Reamers, etc.

The above being a complete assortment of machinists' tools bought and intended to be used by the Niagara Metre Co., now dissolved.

E. S. LEAYCRAFT & SON,
44 Dey St., New York.

MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEICHTON, SYRACUSE, N. Y.

NOW READY



HEAVY 20 INCH
TURRET HEAD MACHINE
For Studs, Screws and General Work.

Patent Friction Clutch Head
For instantly changing from Belt Speed to Back Gears, without stopping.

HOLE IN SPINDLE, 2⅛ INCHES.

REGULAR LATHE CARRIAGE.
With Three Tool Posts. Taper attachment if desired.

HEXAGON TURRET
12 inches in diameter with six 2½ inch holes. Has patent device for unlocking and revolving at variable points.

Weight, 4,400 Pounds.

Bridgeport Machine Tool Works,
BRIDGEPORT, CONN.
E. P. BULLARD, Prop.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

To Lease—Foundry in a growing gas city; will take pay in casting. Address B. B., care AMERICAN MACHINIST.

For Sale—Machine shop and foundry, with gas well; will take considerable of pay in machinery. Address H. H., care AMERICAN MACHINIST.

Cheap—Two H. P. Engine Blue Prints complete. Designed to be built on an ordinary lathe. W. A. Smith & Co., 24 Custom House St., Providence, R. I

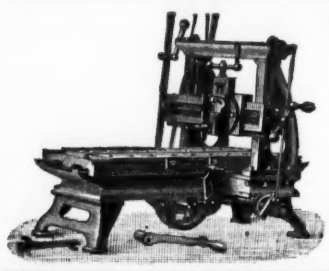
For Sale—Recently patented expansion mandrel with universal and independent blades; will be sold at a reasonable figure. For particulars, address A. J. Ingraham, 812 Arch St., Philadelphia, Pa.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted, Agency—By an exp'd mech. eng., having large acquaintance with rolling-mills, railroads, machine shops, etc. Address Fred. Hoeppner, 95 Westinghouse Building, Pittsburgh, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

A rare opportunity is offered to a man of business ability, with $25,000 to $50,000, to invest in a young established machinery house; to the right party a lucrative position will be given, with full control of his capital; none other need apply to Box 8, AMERICAN MACHINIST.



SMALL POWER OR HAND PLANER.

FOR ANY SMALL WORK.

Weight of Platen 100 lbs.

A. J. WILKINSON & CO.,

184 Washington St., BOSTON, MASS.

SEND FOR CIRCULAR.

BRISTOL'S Patent STEEL BELT LACING.

SAVES TIME, SAVES BELTS, SAVES MONEY, SAVES PATIENCE.

THE BRISTOLS' MFG. CO., Waterbury, Conn.

BELLOWS Beam Micrometer

Send for CATALOGUE to

STANDARD TOOL CO., Athol, Mass.

HUGO BILGRAM,

440 N. 12th St., Phila., Pa.

Maker of all kinds of

MACHINERY.

Special facilities for Accurate Work.

Bevel Gears cut theoretically Correct.

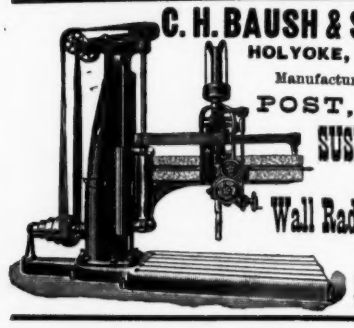
Turret Drill Press.

SIX SPINDLE.

Drills from $\frac{1}{16}$ to $\frac{1}{4}$ hole, speed from 250 to 2000 Rev. Suitable for a large variety of work and is operated with ease and rapidity.

SEND FOR CIRCULAR.

A. D. QUINT, Hartford, Ct.



C. H. BAUSH & SONS,

HOLYOKE, MASS.

Manufacturers of

POST, SUSPENDED AND Wall Radial Drills

From the smallest to the largest.

Montgomery & Co.

Machinists' Tools

AND SUPPLIES.

105 Fulton Street,

NEW YORK CITY.

THE HOWARD MULTIPLE BALL BEARING.

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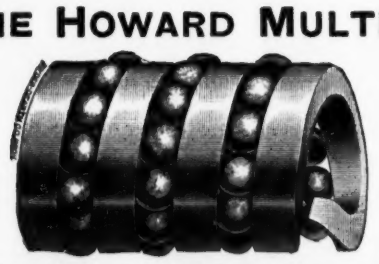
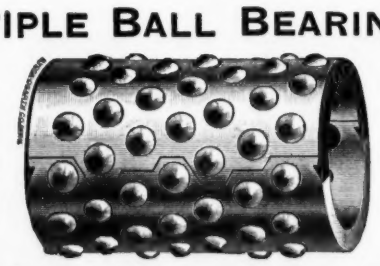




No. 2

Applicable to Frictional Bearings in General. Now running at our works and showing a saving of about two-thirds in power.

MOSSBERG MANUFACTURING CO., Attleboro, Mass.

MILLING MACHINES and PATENT CUTTERS.

Do not buy without getting our prices, photos and references. We make machines to mill up to 22 in. wide by 10 ft. long, very heavy and powerful. Correspondence solicited.

THE INCERSOLL MILLING MACHINE CO.,

ROCKFORD, ILL.

DRAWINGS, FINE MACHINERY AND TOOLS TO ORDER.

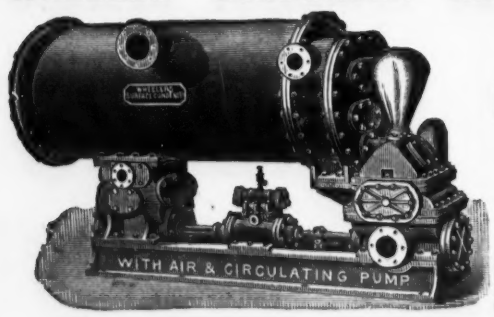
DRILL PRESSES FOR LIGHT WORK.

Send for Particulars.

MILLIKEN & D'AMOUR,

151 and 153 Cedar Street, NEW YORK CITY

WHEELER CONDENSER AND ENGINEERING CO.



92 & 94 Liberty Street, New York.

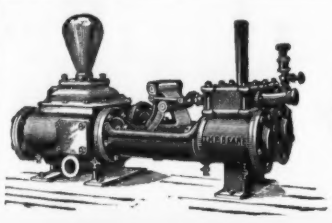
MANUFACTURERS OF IMPROVED

SURFACE CONDENSERS.

ALSO SUCCESSORS TO THE

Colwell Iron Works.

Machinery for Sugar Plantations and Refineries. Vacuum Pans, Double and Triple Effects, &c. Blowing Engines for Blast Furnaces. Iron and Brass Castings for the Trade. Heavy Machinery a Specialty.



THE DEANE

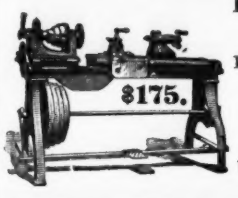
OF HOLYOKE

STEAM PUMPS

DEANE STEAM PUMP CO.,

HOLYOKE, MASS.

FOR TOOLS. **CRESCENT STEEL** FOR DIES.



Improved Screw Cutting Foot and Power. **LATHES**

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

THE SEBASTIAN-MAY CO.,

167 to 175 Highland Avenue, SIDNEY, OHIO.

MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

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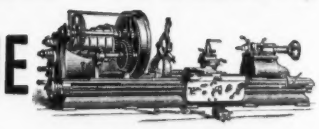

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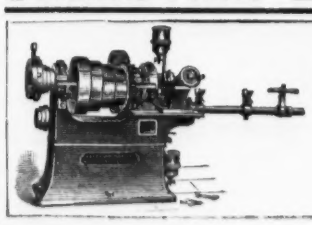

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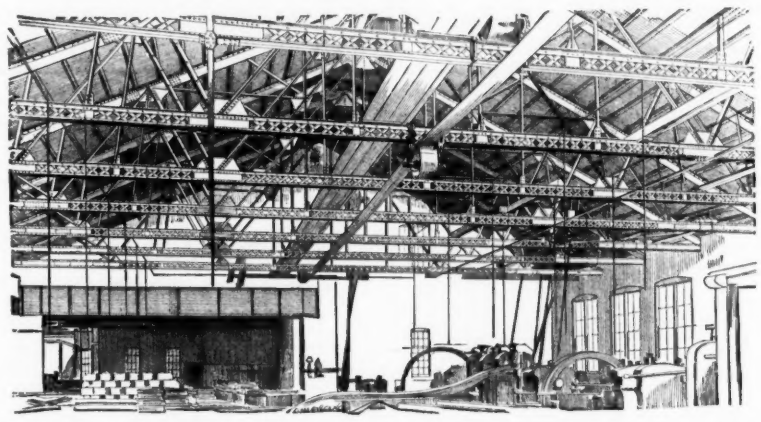

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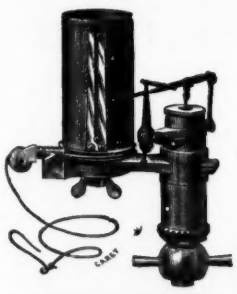

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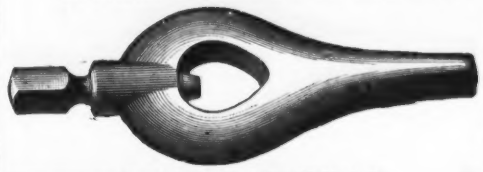

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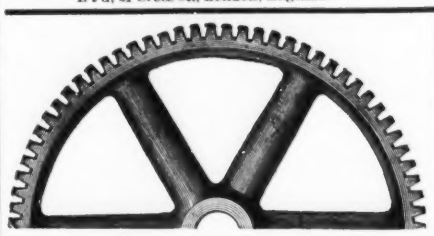

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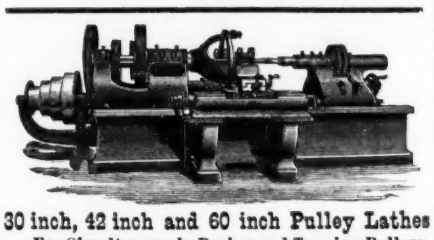

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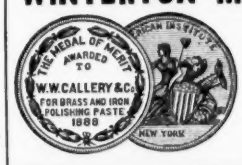

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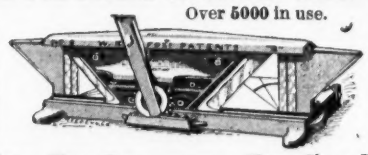

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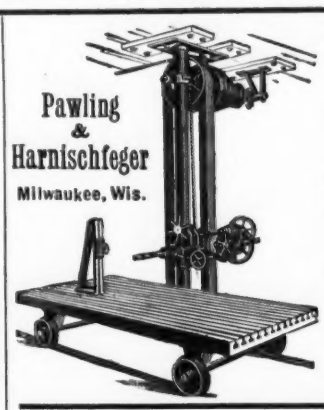

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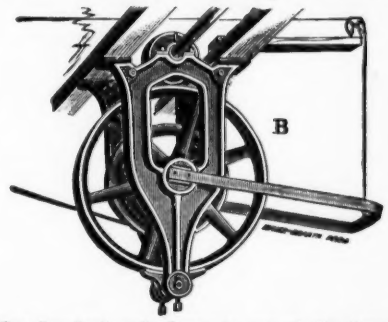

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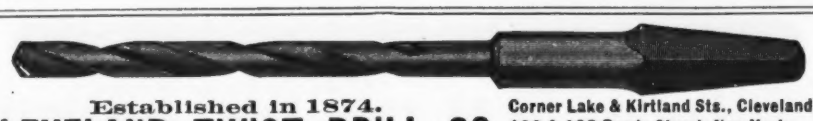

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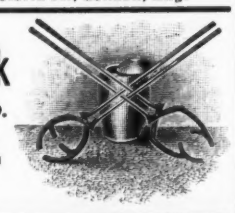

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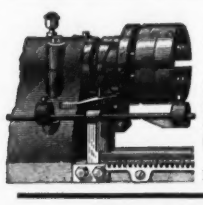

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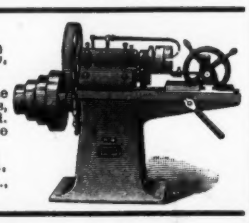

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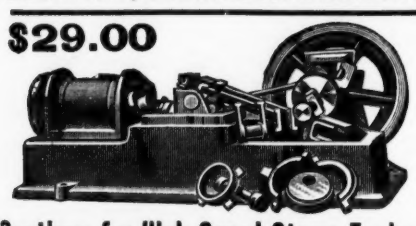

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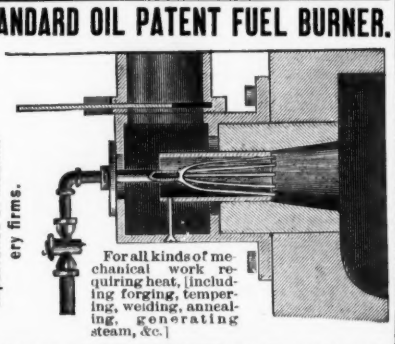

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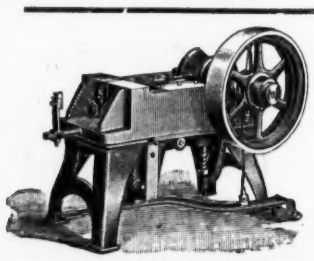

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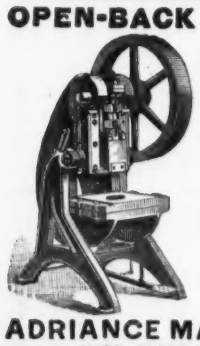

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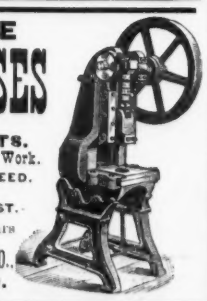

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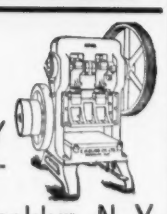

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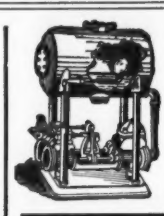

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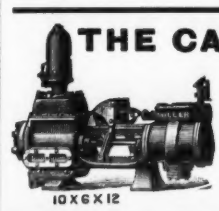

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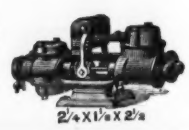

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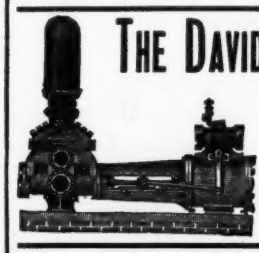

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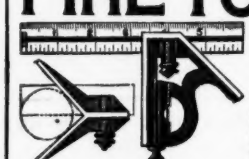

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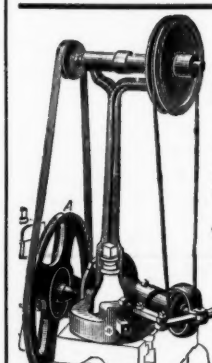

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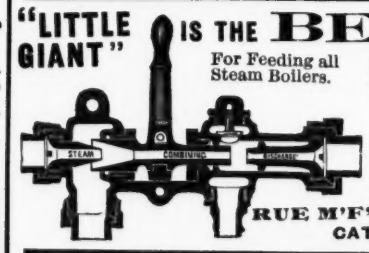

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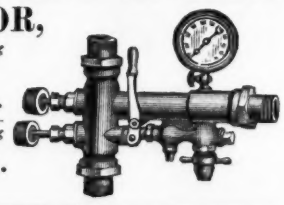

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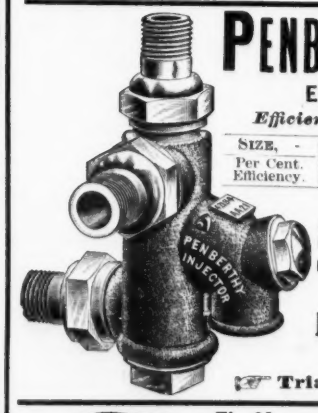

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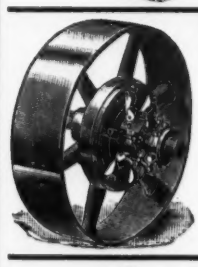

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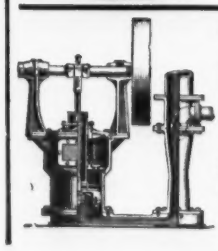

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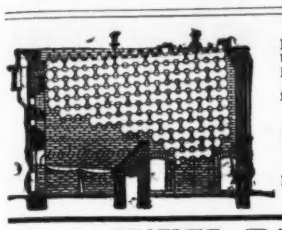

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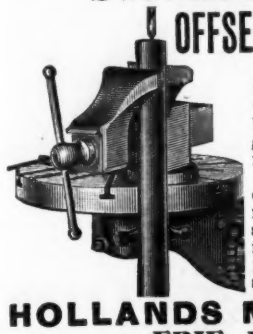

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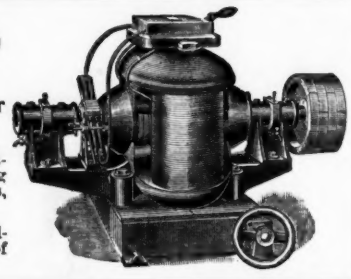

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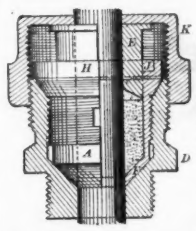

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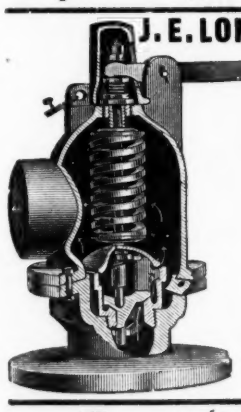

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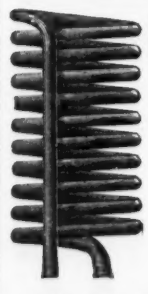

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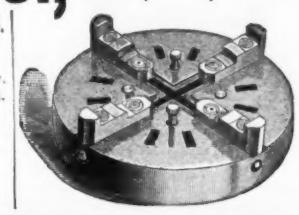

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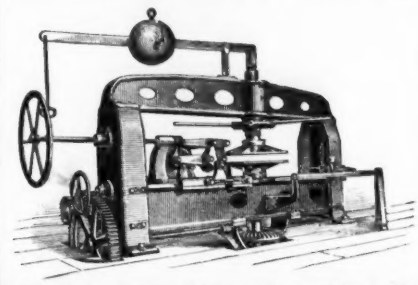

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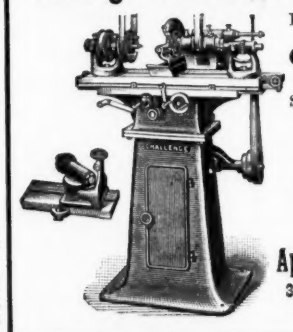

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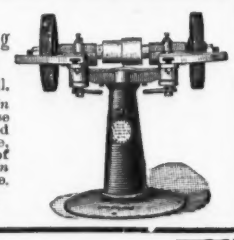

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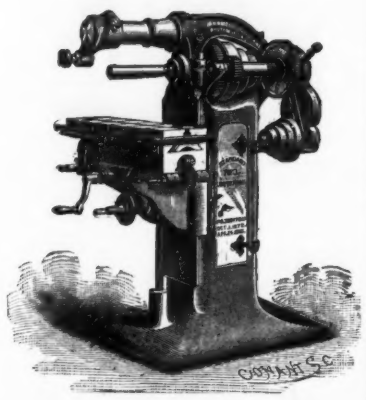

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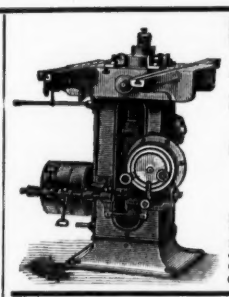

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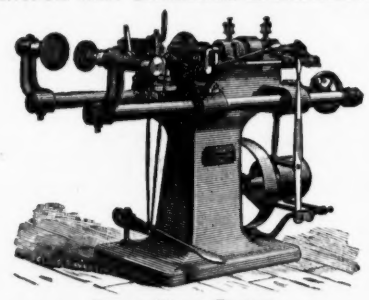

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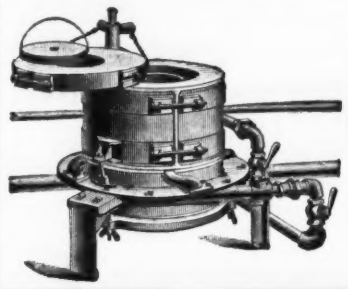

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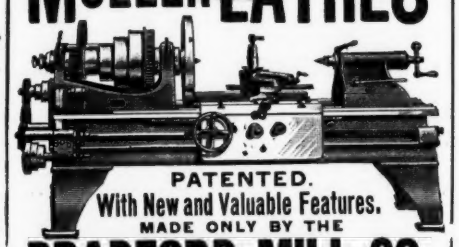

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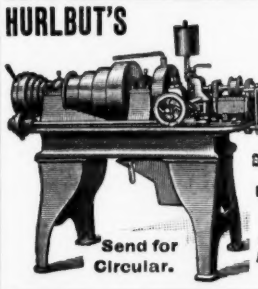

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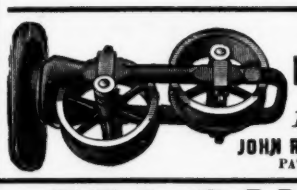

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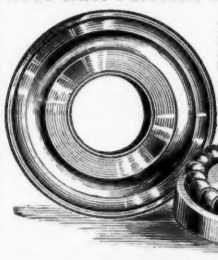

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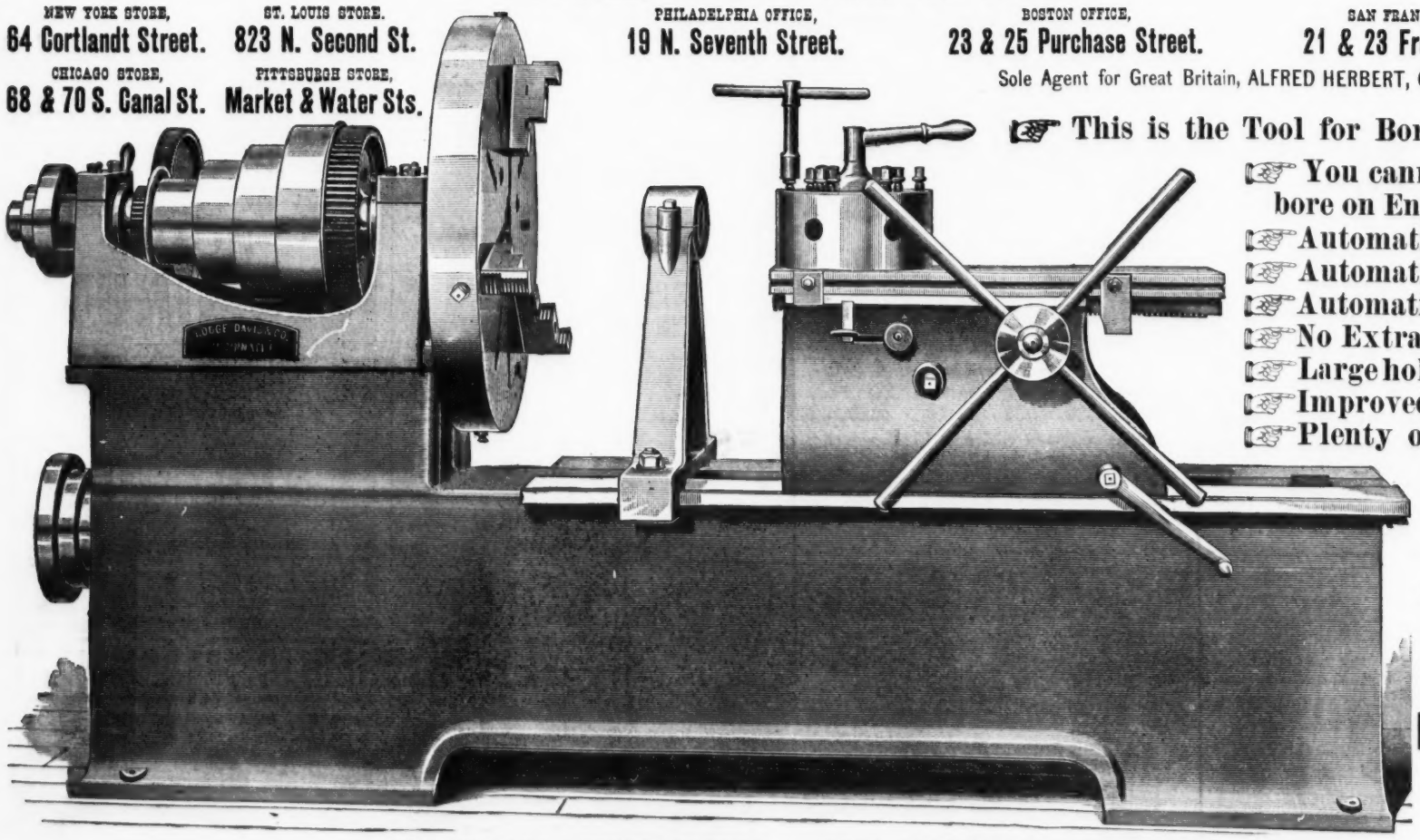

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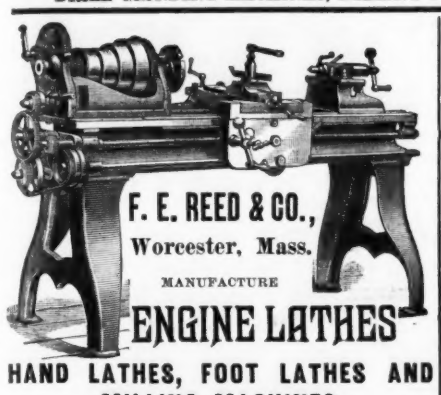

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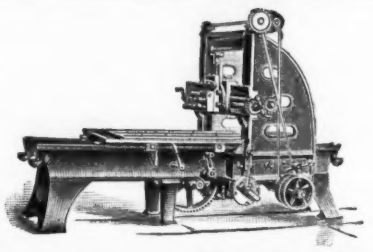

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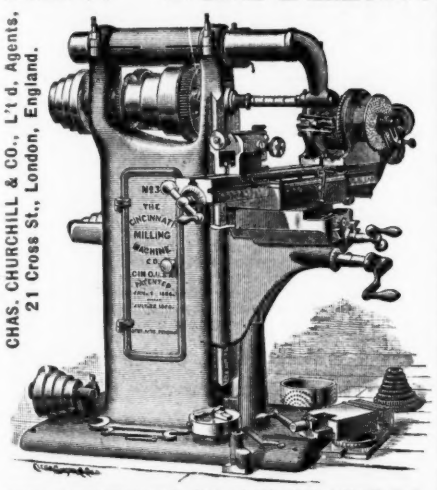

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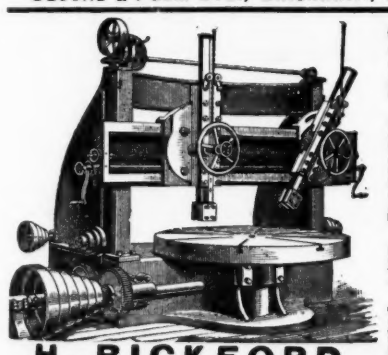

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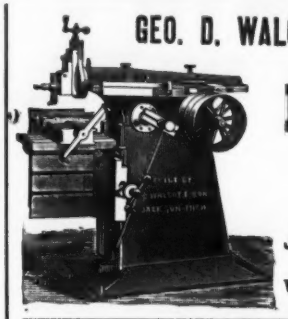

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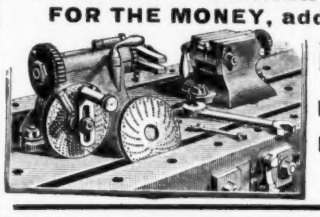

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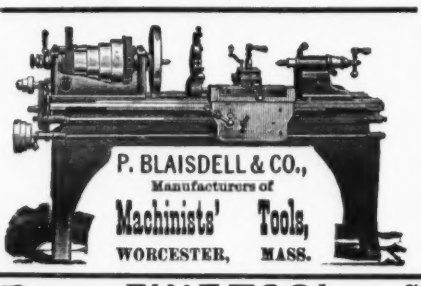

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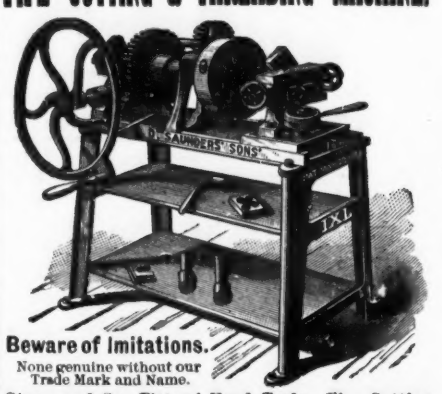

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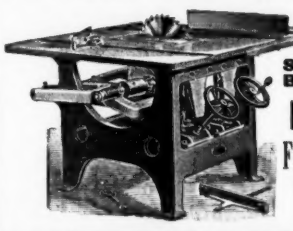

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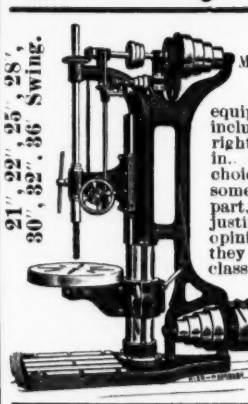

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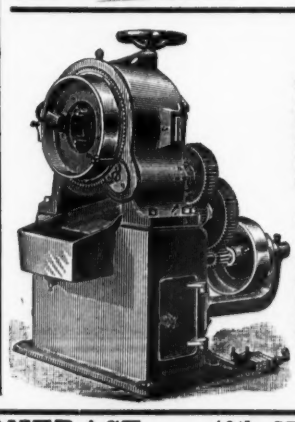

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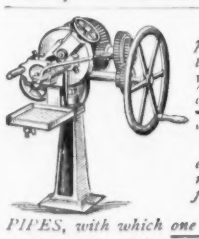

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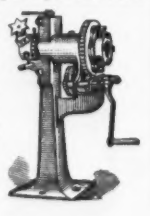

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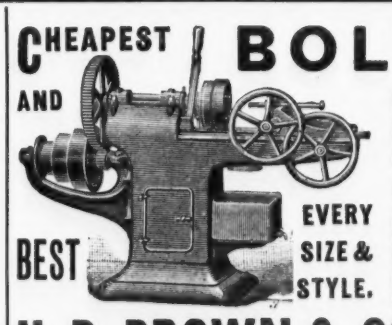

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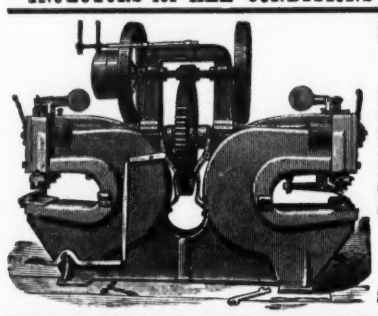

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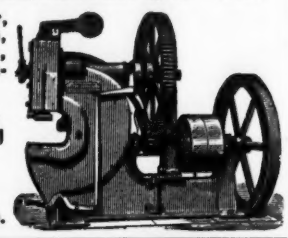

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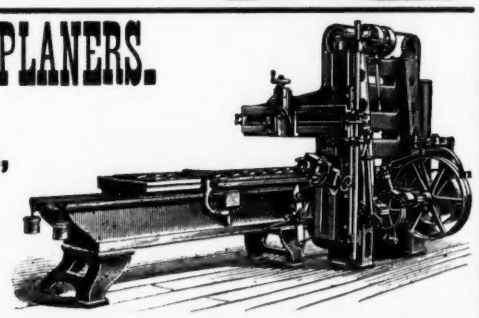

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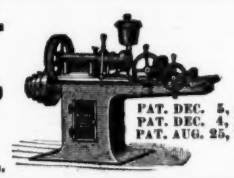

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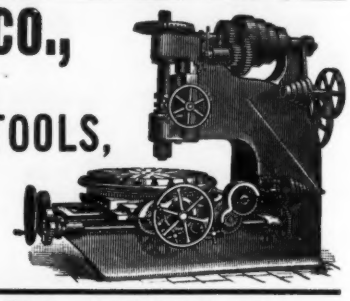

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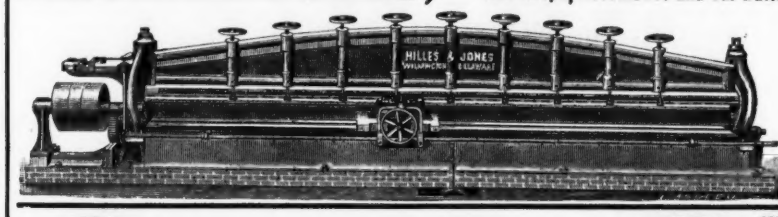

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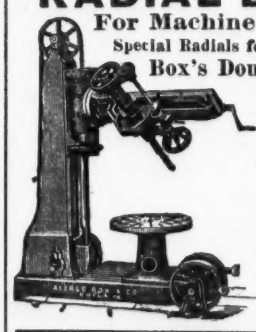

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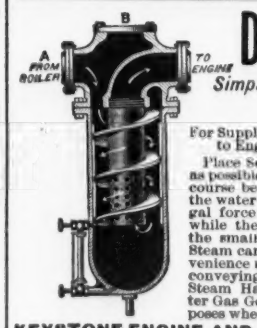

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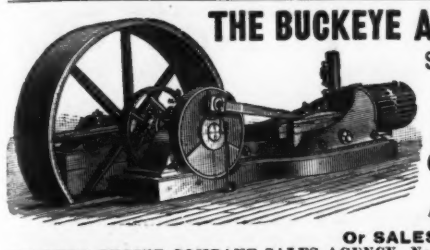

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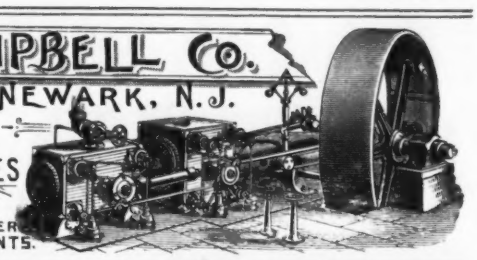

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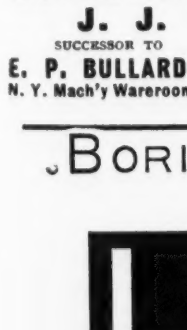

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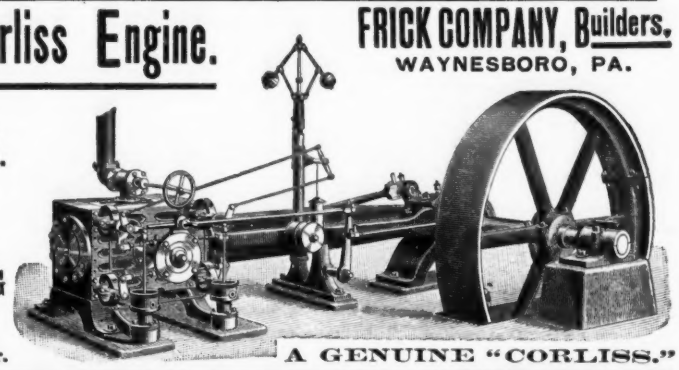

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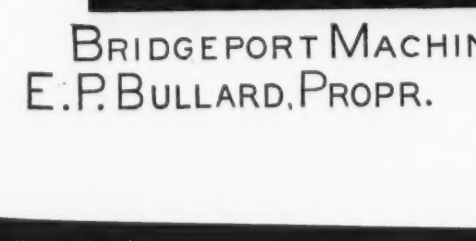

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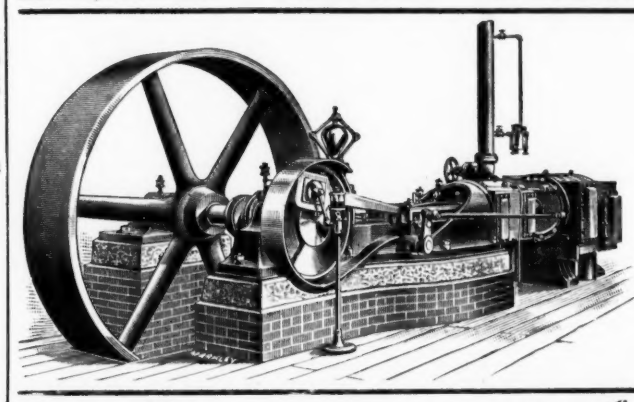

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1 Planer, 24 in. do 6 ft. do	do do
1 Planer, 28 in. do 6 ft. do	do do
1 Planer, 28 in. do 8 ft. do	do do
1 Planer, 32 in. do 10 ft. do	do do
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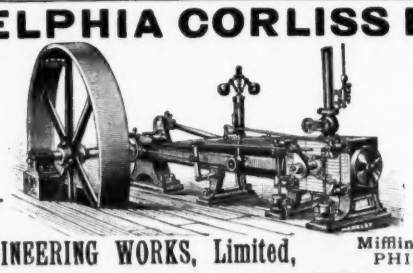

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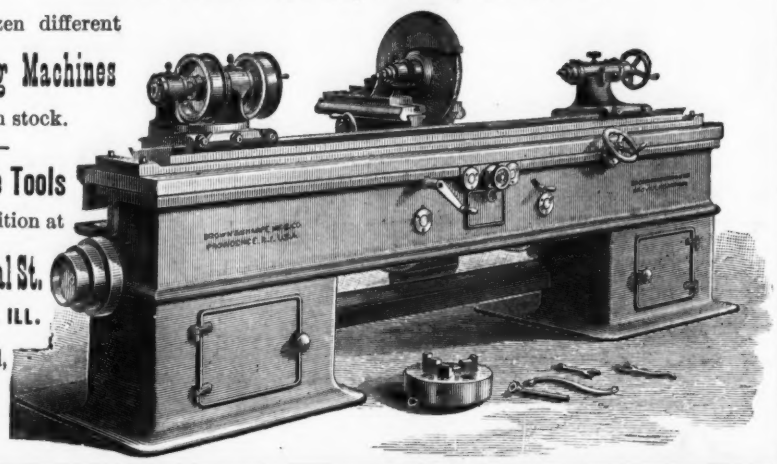

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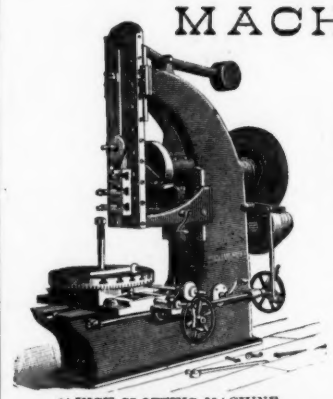

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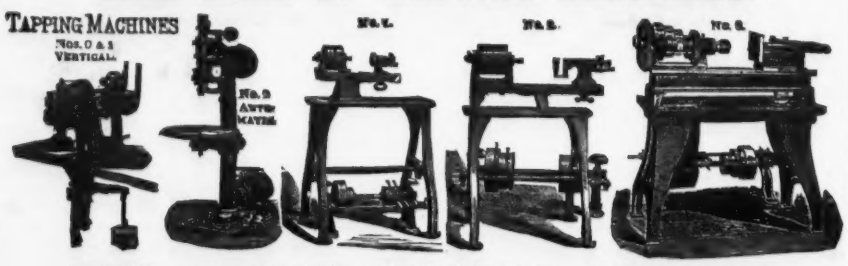

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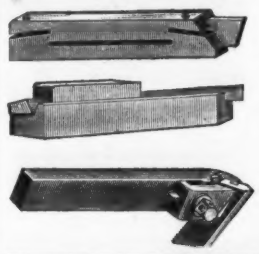

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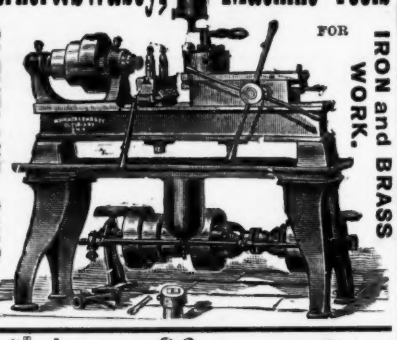

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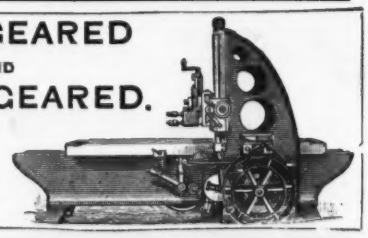

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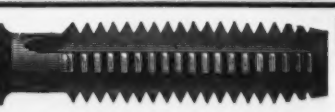

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